DeClassified
LRoss
6/28/94

1. Site Name: Doty Sand Pit
   (as entered in CERCLIS)

2. Site CERCLIS Number: TXD000327726

3. Site Reviewer: Alex Zocchi

4. Date: May 18,1992

5. Site Location: Houston, Harris County, Texas
   (City/County,State)

6. Congressional District: 18

7. Site Coordinates: Single

   Latitude: 29°40'48.0"   Longitude: 95°35'36.0"

	Score
Ground Water Migration Pathway Score (Sgw)	43.53
Surface Water Migration Pathway Score (Ssw)	0.00
Soil Exposure Pathway Score (Ss)	11.25
Air Migration Pathway Score (Sa)	3.21

Site Score	22.54

NOTE

EPA uses the terms "facility," "site," and "release"
interchangeably. The term "facility" is broadly defined in CERCLA
to include any area where hazardous substances have "come to be
located" (CERCLA Section 109(9)), and the listing process is not
intended to define or reflect boundaries of such facilities or
releases. Site names, and references to specific parcels or
properties, are provided for general identification purposes only.
Knowledge regarding the extent of sites will be refined as more
information is developed during the RI/FS and even during
implementation of the remedy.

1. WASTESTREAM QUANTITY SUMMARY TABLE, SOURCE: Ponded Water

a. Wastestream ID	Ponded Water
b. Hazardous Constituent Quantity (C) (lbs.)	0.00
c. Data Complete?	NO
d. Hazardous Wastestream Quantity (W) (lbs.)	0.00
e. Data Complete?	NO
f. Wastestream Quantity Value (W/5,000)	0.00E+00

a. Wastestream ID	Drum Storage Area
b. Hazardous Constituent Quantity (C) (lbs.)	0.00
c. Data Complete?	NO
d. Hazardous Wastestream Quantity (W) (lbs.)	0.00
e. Data Complete?	NO
f. Wastestream Quantity Value (W/5,000)	0.00E+00

2.　SOURCE HAZARDOUS WASTE QUANTITY FACTOR TABLE

a. Source ID		Ponded Water	
b. Source Type		Surface Impoundment	
c. Secondary Source Type		N.A.	
d. Source Volume (yd3)	Source Area (ft2)	463.00	0.00
e. Source Volume/Area Value		1.85E+02	
f. Source Hazardous Constituent Quantity (HCQ) Value (sum of 1b)		0.00E+00	
g. Data Complete?		NO	
h. Source Hazardous Wastestream Quantity (WSQ) Value (sum of 1f)		0.00E+00	
i. Data Complete?		NO	
k. Source Hazardous Waste Quantity (HWQ) Value (2e, 2f, or 2h)		1.85E+02	

Source Hazardous Substances	Depth (feet)	Liquid	Concent.	Units
Barium	< 2	YES	2.5E+02	ppm
Benzene	< 2	YES	5.0E-03	ppm
Bis (2-ethylhexyl) phthalate	< 2	YES	2.3E+01	ppm
Cadmium	< 2	NO	2.5E+00	ppm
Chromium	< 2	NO	2.3E+01	ppm
Copper	< 2	NO	1.8E+01	ppm
Lead	< 2	NO	2.0E+01	ppm
Manganese	< 2	YES	3.8E+02	ppm

Documentation for Source Type:

　　The source is an area of ponded water. Analysis of samples taken from the pond indicated the presence of metals, solvents and semi-volatiles (Ref. 14).

Reference: 14

Documentation for Secondary Source Type:

     There are no active fire areas or burn pits on-site (Ref. 14).

Reference: 14

Documentation for Source Hazardous Substances:

     Analyses of samples taken from the pond water indicated the presence
     of both inorganic and organic contaminants in the water sample
     (Station (b) (6)) and the sediment sample (Station (b) (6)). The samples were
     collected the week of January 22, 1991. Because this is a source
     sample and no representative sample could be collected, the
     concentrations detected will be compared to the corresponding CRDLs
     and CRQLs.

     Station (b) (6)
     CRDLs(all concentrations expressed in ppm): Barium: 0.200; Copper:
     0.025; Manganese: 0.015;
     CRQLs(all concentrations expressed in ppm); Benzene: 0.005

     Concentrations Detected: Barium: 0.413, Copper: 0.026, Manganese:
     0.320, Benzene: 0.005

     Station (b) (6) (Sediment)
     CRDLs(all concentrations expressed in ppm): Barium: 40.0; Cadmium:
     1.0; Chromium: 2.0; Copper: 5.0; Lead: 0.6; Manganese: 3.0;
     Vanadium: 10.0; Zinc: 4.0

     CRQLs(all concentrations expressed in ppm):
     Bis(2-ethyl-hexyl)phthalate: 1.29

     Concentrations detected: Barium: 251.0; Cadmium: 2.5; Chromium:
     22.6J; Copper: 17.5; Lead: 20.1; Manganese: 378.0; Vanadium: 24.2;
     Zinc: 47.6J; Bis(2-ethyl-hexyl)phthalate: 23.0.

     Concentrations of chromium and zinc are estimates due to QA/QC out
     of control limits and have been flagged as J'd data.

Reference: 14

Documentation for Source Volume:

   The volume of the pond was estimated to be 50 x 50 x 5 feet.
   Analyses of samples from the pond revealed the presence of metals,
   solvents and semi-volatiles (Ref. 14).

      50 ft. x 50 ft. x 5 ft. = 12500 cu ft.

   To convert to cubic yards: 1 cubic yard = 27 cubic feet
      12,500 cubic feet/ 27 cubic feet= 462.96 cubic yards

Reference: 14

Documentation for Source Area:

   Because volume was used to calculate the waste quantity, the area
   waste quantity factor value will not be calculated.

Reference: 14

1.   WASTESTREAM QUANTITY SUMMARY TABLE, SOURCE: Drum Storage Area

a. Wastestream ID	
b. Hazardous Constituent Quantity (C) (lbs.)	0.00
c. Data Complete?	NO
d. Hazardous Wastestream Quantity (W) (lbs.)	0.00
e. Data Complete?	NO
f. Wastestream Quantity Value (W/5,000)	0.00E+00

2. SOURCE HAZARDOUS WASTE QUANTITY FACTOR TABLE

a. Source ID		Drum Storage Area	
b. Source Type		Contaminated Soil	
c. Secondary Source Type		N.A.	
d. Source Volume (yd3)	Source Area (ft2)	0.00	5000.00
e. Source Volume/Area Value		1.47E-01	
f. Source Hazardous Constituent Quantity (HCQ) Value (sum of 1b)		0.00E+00	
g. Data Complete?		NO	
h. Source Hazardous Wastestream Quantity (WSQ) Value (sum of 1f)		0.00E+00	
i. Data Complete?		NO	
k. Source Hazardous Waste Quantity (HWQ) Value (2e, 2f, or 2h)		1.47E-01	

Source Hazardous Substances	Depth (feet)	Liquid	Concent.	Units
Acenaphthylene	< 2	NO	2.3E+00	ppm
Anthracene	< 2	NO	1.0E+01	ppm
Benz(a)anthracene	< 2	NO	2.6E+01	ppm
Benzo(a)pyrene	< 2	NO	2.3E+01	ppm
Benzo(j,k)fluorene	< 2	NO	1.2E+01	ppm
Chrysene	< 2	NO	2.3E+01	ppm
Cobalt	< 2	NO	2.7E+01	ppm
Copper	< 2	NO	6.0E+02	ppm
Fluorene	< 2	NO	5.5E+01	ppm
Iron	< 2	NO	4.4E+04	ppm
Lead	< 2	NO	2.8E+02	ppm
Manganese	< 2	NO	4.0E+02	ppm
Phenanthrene	< 2	NO	2.8E+01	ppm
Toluene	< 2	NO	1.7E-02	ppm
Zinc	< 2	NO	3.6E+03	ppm

Documentation for Source Type:

    Analyses of samples taken from the stained soil, indicated the
    presence of metals, VOAs and semi-volatiles. During the Screening
    Site Inspection, the area was being bulldozed (Ref. 14). This area
    was being utilized to store drums.

Reference: 14

Documentation for Secondary Source Type:

    There is no indication of active fire areas or burn pits on-site
    (Ref. 14).

Reference: 14

Documentation for Source Hazardous Substances:

    Analyses of samples taken from the stained soil indicated the
    presence of metals, VOAs and semi-volatiles at concentrations
    greater than 3 times background values (Ref. 14). The samples were
    collected the week of January 22, 1991.

    Background Concentrations (Station ▮): all concentrations expressed
    in parts per million (ppm).
    Chromium: 6.9J; Cobalt: 2.6; Copper: 2.6; Arsenic: 0.88J; Cadmium:
    0.53; Lead: 4.5; Zinc: 7.4J; Acenaphthylene: ND; Flourene: ND;
    Phenanthrene: ND; Flouranthene: ND; Pyrene: ND; Benzo(a)anthracene:
    ND; Chrysene: ND; Benzo(b)fluoranthene: ND; Benzo(k)fluoranthene:
    ND; Benzo(a)pyrene: ND; Indeno(1,2,3-CD)pyrene: ND;
    Benzo(G,H,I)perylene: ND; Toluene: ND; 4-methyl-2-pentanone: ND

    Inorganic Contract Required Detection Limits (CRDLs), all
    concentrations expressed in ppm: Arsenic: 1.0; Cadmium: 1.0;
    Chromium: 2.0; Cobalt: 10.0; Copper: 5.0; Lead: 0.6; Zinc: 4.0

    Organic Contract Quantification Limits (CRQLs), all concentrations
    expressed in ppm: Toluene: 0.005; 4-methyl-2 pentanone: 0.005; All
    semi-volatile CRQLs are 1.29 ppm.
    All concentrations expressed in ppm

Station (b)(6) (Oil Dump Stain): Chromium: 35.8J; Cobalt: 27.2; Copper: 596.0; Lead: 275.0J; Manganese: 403.0; Zinc: 3,620J; toluene: 0.017; 4-methyl-2-pentanone: 0.081.

Station (b)(6) (Drum soil): Arsenic: 3.4J; Cadmium: 2.4; Copper: 13.5; Lead: 51.9; Zinc: 65.1.

Station (b)(6) (Duplicate of Station (b)(6)): Copper: 24.4; Lead: 40.3J; Zinc: 78.9;.

Station (b)(6) (Drum Drainage): Copper: 11.8; Lead: 26.4; Zinc: 51.8; Acenaphthylene: 2.3; Fluorene: 2.9; Phenanthrene:28.0; Anthracene: 10.0; Fluoranthene: 55.0; Pyrene: 52.0; Benzo(a)anthracene: 26.0; Chrysene: 23.0; Benzo(b)fluoranthene: 30.0; Benzo(K)fluoranthene: 12.0J; Benzo(a)pyrene: 23.0J, Indeno(1,2,3-CD)pyrene: 8.0; Benzo(G,H,I)perylene: 5.7.

Concentrations of chromium, lead and zinc are considered to be estimates due to QA/QC out of control limits and have been flagged as J'd data.

Reference: 14

Documentation for Source Volume:

The depth of contamination in the soil is not known; thus, the waste quanty value for volume cannot be calculated for the Drum Storage area.

Reference: 14

Documentation for Source Area:

The area of stained soil was estimated to be approximately 5000 sq ft during the on-site reconnaissance (Ref. 14).

Reference: 14

1.   WASTESTREAM QUANTITY SUMMARY TABLE, SOURCE: Old Landfill

a. Wastestream ID	
b. Hazardous Constituent Quantity (C) (lbs.)	0.00
c. Data Complete?	NO
d. Hazardous Wastestream Quantity (W) (lbs.)	0.00
e. Data Complete?	NO
f. Wastestream Quantity Value (W/5,000)	0.00E+00

2. SOURCE HAZARDOUS WASTE QUANTITY FACTOR TABLE

a. Source ID	Old Landfill	
b. Source Type	Landfill	
c. Secondary Source Type	N.A.	
d. Source Volume (yd3) / Source Area (ft2)	0.00	4791600.00
e. Source Volume/Area Value	1.41E+03	
f. Source Hazardous Constituent Quantity (HCQ) Value (sum of 1b)	0.00E+00	
g. Data Complete?	NO	
h. Source Hazardous Wastestream Quantity (WSQ) Value (sum of 1f)	0.00E+00	
i. Data Complete?	NO	
k. Source Hazardous Waste Quantity (HWQ) Value (2e, 2f, or 2h)	1.41E+03	

Documentation for Source Type:

The old landfill begain operations in 1958 and ceased in 1970. The
landfill has been closed and covered with fill material. It is
approximately 110.0 acres in size. The amount of waste disposed
into the landfill is not known, nor is the operating procedures
known.

Reference: 1,3

Documentation for Secondary Source Type:

> There are no active fire areas or burn pits located within the old
> landfill area.

Reference: 9

Documentation for Source Hazardous Substances:

> There were no samples collected from this source during the FIT SSI
> performed during the week of January 22,1991.

Reference: 14

Documentation for Source Area:

> The old landfill is approximately 110.0 acres in size. The size was
> determined by using a U.S.G.S topographical map with the site
> boundaries added to the map. Because the actual amount of waste
> disposed into the old landfill is not known nor are the actual
> dimensions (depth) of the landfill not known, the area of the
> landfill will be evaluated.

> 1 acre= 43,560 square feet
> 110.0 acres X 43,560 square feet= 4,791,600 square feet

Reference: 1,3

3.   SITE HAZARDOUS WASTE QUANTITY SUMMARY

No.	Source ID	Migration Pathways	Vol. or Area Value (2e)	Constituent or Wastestream Value (2f,2h)	Hazardous Waste Qty. Value (2k)
1	Ponded Water	GW-SW-SE-A	1.85E+02	0.00E+00	1.85E+02
2	Drum Storage Area	GW-SW-SE-A	1.47E-01	0.00E+00	1.47E-01
3	Old Landfill	GW-SW-A	1.41E+03	0.00E+00	1.41E+03

4. PATHWAY HAZARDOUS WASTE QUANTITY AND WASTE CHARACTERISTICS SUMMARY TABLE

Migration Pathway	Contaminant Values		HWQVs*	WCVs**
Ground Water	Toxicity/Mobility	1.00E+04	100	32
SW: Overland Flow, DW	Tox./Persistence	1.00E+04	100	32
SW: Overland Flow, HFC	Tox./Persis./Bioacc.	5.00E+07	100	180
SW: Overland Flow, Env	Etox./Persis./Bioacc.	5.00E+08	100	320
SW: GW to SW, DW	Tox./Persistence	1.00E+04	100	32
SW: GW to SW, HFC	Tox./Persis./Bioacc.	5.00E+07	100	180
SW: GW to SW, Env	Etox./Persis./Bioacc.	2.00E+08	100	320
Soil Exposure:Resident	Toxicity	1.00E+04	100	32
Soil Exposure: Nearby	Toxicity	1.00E+04	100	32
Air	Toxicity/Mobility	1.00E+02	100	10

  * Hazardous Waste Quantity Factor Values
 ** Waste Characteristics Factor Category Values

Note: SW = Surface Water
         GW = Ground Water
         DW = Drinking Water Threat
         HFC = Human Food Chain Threat
         Env = Environmental Threat

GROUND WATER MIGRATION PATHWAY Factor Categories & Factors	Maximum Value	Value Assigned
Likelihood of Release to an Aquifer Aquifer: Lower Chicot		
1. Observed Release	550	0
2. Potential to Release		
2a. Containment	10	10
2b. Net Precipitation	10	3
2c. Depth to Aquifer	5	5
2d. Travel Time	35	35
2e. Potential to Release [lines 2a(2b+2c+2d)]	500	430
3. Likelihood of Release	550	430
Waste Characteristics		
4. Toxicity/Mobility	*	1.00E+04
5. Hazardous Waste Quantity	*	100
6. Waste Characteristics	100	32
Targets		
7. Nearest Well	50	2.00E+01
8. Population		
8a. Level I Concentrations	**	0.00E+00
8b. Level II Concentrations	**	0.00E+00
8c. Potential Contamination	**	4.00E+00
8d. Population (lines 8a+8b+8c)	**	4.00E+00
9. Resources	5	5.00E+00
10. Wellhead Protection Area	20	5.00E+00
11. Targets (lines 7+8d+9+10)	**	3.40E+01
12. Targets (including overlaying aquifers)	**	2.61E+02
13. Aquifer Score	100	43.53
GROUND WATER MIGRATION PATHWAY SCORE (Sgw)	100	43.53

  * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors DRINKING WATER THREAT	Maximum Value	Value Assigned
Likelihood of Release		
1. Observed Release	550	0
2. Potential to Release by Overland Flow		
2a. Containment	10	10
2b. Runoff	25	4
2c. Distance to Surface Water	25	0
2d. Potential to Release by Overland Flow [lines 2a(2b+2c)]	500	40
3. Potential to Release by Flood		
3a. Containment (Flood)	10	10
3b. Flood Frequency	50	7
3c. Potential to Release by Flood (lines 3a x 3b)	500	70
4. Potential to Release (lines 2d+3c)	500	110
5. Likelihood of Release	550	110
Waste Characteristics		
6. Toxicity/Persistence	*	1.00E+04
7. Hazardous Waste Quantity	*	100
8. Waste Characteristics	100	32
Targets		
9. Nearest Intake	50	0.00E+00
10. Population		
10a. Level I Concentrations	**	0.00E+00
10b. Level II Concentrations	**	0.00E+00
10c. Potential Contamination	**	0.00E+00
10d. Population (lines 10a+10b+10c)	**	0.00E+00
11. Resources	5	0.00E+00
12. Targets (lines 9+10d+11)	**	0.00E+00
13. DRINKING WATER THREAT SCORE	100	0.00

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors HUMAN FOOD CHAIN THREAT	Maximum Value	Value Assigned
Likelihood of Release		
14. Likelihood of Release (same as line 5)	550	110
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	*	5.00E+07
16. Hazardous Waste Quantity	*	100
17. Waste Characteristics	1000	180
Targets		
18. Food Chain Individual	50	0.00E+00
19. Population		
19a. Level I Concentrations	**	0.00E+00
19b. Level II Concentrations	**	0.00E+00
19c. Pot. Human Food Chain Contamination	**	0.00E+00
19d. Population (lines 19a+19b+19c)	**	0.00E+00
20. Targets (lines 18+19d)	**	0.00E+00
21. HUMAN FOOD CHAIN THREAT SCORE	100	0.00

  * Maximum value applies to waste characteristics category.
 ** Maximum value not applicable.

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors ENVIRONMENTAL THREAT	Maximum Value	Value Assigned
Likelihood of Release		
22. Likelihood of Release (same as line 5)	550	110
Waste Characteristics		
23. Ecosystem Toxicity/Persistence/Bioacc.	*	5.00E+08
24. Hazardous Waste Quantity	*	100
25. Waste Characteristics	1000	320
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	**	0.00E+00
26b. Level II Concentrations	**	0.00E+00
26c. Potential Contamination	**	0.00E+00
26d. Sensitive Environments (lines 26a+26b+26c)	**	0.00E+00
27. Targets (line 26d)	**	0.00E+00
28. ENVIRONMENTAL THREAT SCORE	60	0.00
29. WATERSHED SCORE	100	0.00
30. SW: OVERLAND/FLOOD COMPONENT SCORE (Sof)	100	0.00

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

GROUND WATER TO SURFACE WATER MIGRATION COMPONENT Factor Categories & Factors DRINKING WATER THREAT	Maximum Value	Value Assigned
Likelihood of Release to Aquifer Aquifer: Evangeline		
1. Observed Release	550	0
2. Potential to Release		
2a. Containment	10	10
2b. Net Precipitation	10	3
2c. Depth to Aquifer	5	5
2d. Travel Time	35	35
2e. Potential to Release [lines 2a(2b+2c+2d)]	500	430
3. Likelihood of Release	550	430
Waste Characteristics		
4. Toxicity/Mobility/Persistence	*	1.00E+04
5. Hazardous Waste Quantity	*	100
6. Waste Characteristics	100	32
Targets		
7. Nearest Intake	50	0.00E+00
8. Population		
8a. Level I Concentrations	**	0.00E+00
8b. Level II Concentrations	**	0.00E+00
8c. Potential Contamination	**	0.00E+00
8d. Population (lines 8a+8b+8c)	**	0.00E+00
9. Resources	5	0.00E+00
10. Targets (lines 7+8d+9)	**	0.00E+00
11. DRINKING WATER THREAT SCORE	100	0.00

  * Maximum value applies to waste characteristics category.
 ** Maximum value not applicable.

GROUND WATER TO SURFACE WATER MIGRATION COMPONENT Factor Categories & Factors HUMAN FOOD CHAIN THREAT	Maximum Value	Value Assigned
Likelihood of Release		
12. Likelihood of Release (same as line 3)	550	430
Waste Characteristics		
13. Toxicity/Mobility/Persistence/Bioacc.	*	5.00E+07
14. Hazardous Waste Quantity	*	100
15. Waste Characteristics	1000	180
Targets		
16. Food Chain Individual	50	0.00E+00
17. Population		
17a. Level I Concentrations	**	0.00E+00
17b. Level II Concentrations	**	0.00E+00
17c. Pot. Human Food Chain Contamination	**	0.00E+00
17d. Population (lines 17a+17b+17c)	**	0.00E+00
18. Targets (lines 16+17d)	**	0.00E+00
19. HUMAN FOOD CHAIN THREAT SCORE	100	0.00

  * Maximum value applies to waste characteristics category.
 ** Maximum value not applicable.

GROUND WATER TO SURFACE WATER MIGRATION COMPONENT Factor Categories & Factors ENVIRONMENTAL THREAT	Maximum Value	Value Assigned
Likelihood of Release		
20. Likelihood of Release (same as line 3)	550	430
Waste Characteristics		
21. Ecosystem Tox./Mobility/Persist./Bioacc. 22. Hazardous Waste Quantity 23. Waste Characteristics	* * 1000	2.00E+08 100 320
Targets		

24. Sensitive Environments
   24a. Level I Concentrations
   24b. Level II Concentrations
   24c. Potential Contamination
   24d. Sensitive Environments
      (lines 24a+24b+24c)
25. Targets (line 24d)
	
	**
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		0.00E+00
		0.00E+00
		0.00E+00
		0.00E+00
		
		0.00E+00

26. ENVIRONMENTAL THREAT SCORE	60	0.00
27. WATERSHED SCORE	100	0.00
28. SW: GW to SW COMPONENT SCORE (Sgs)	100	0.00

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

SOIL EXPOSURE PATHWAY Factor Categories & Factors RESIDENT POPULATION THREAT	Maximum Value	Value Assigned
Likelihood of Exposure		
1. Likelihood of Exposure	550	550
Waste Characteristics		
2. Toxicity	*	1.00E+04
3. Hazardous Waste Quantity	*	100
4. Waste Characteristics	100	32
Targets		
5. Resident Individual	50	4.50E+01
6. Resident Population		
6a. Level I Concentrations	**	0.00E+00
6b. Level II Concentrations	**	2.70E+00
6c. Resident Population (lines 6a+6b)	**	2.70E+00
7. Workers	15	5.00E+00
8. Resources	5	0.00E+00
9. Terrestrial Sensitive Environments	***	0.00E+00
10. Targets (lines 5+6c+7+8+9)	**	5.27E+01
11. RESIDENT POPULATION THREAT SCORE	**	9.28E+05

  * Maximum value applies to waste characteristics category.
 ** Maximum value not applicable.
*** No specific maximum value applies, see HRS for details.

SOIL EXPOSURE PATHWAY Factor Categories & Factors NEARBY POPULATION THREAT	Maximum Value	Value Assigned
Likelihood of Exposure		
12. Attractiveness/Accessibility	100	2.50E+01
13. Area of Contamination	100	5.00E+00
14. Likelihood of Exposure	500	5.00E+00
Waste Characteristics		
15. Toxicity	*	1.00E+04
16. Hazardous Waste Quantity	*	100
17. Waste Characteristics	100	32
Targets		
18. Nearby Individual	1	0.00E+00
19. Population Within 1 Mile	**	2.00E+00
20. Targets (lines 18+19)	**	2.00E+00
21. NEARBY POPULATION THREAT SCORE	**	3.20E+02
SOIL EXPOSURE PATHWAY SCORE (Ss)	100	11.25

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

AIR MIGRATION PATHWAY Factor Categories & Factors	Maximum Value	Value Assigned
Likelihood of Release		
1. Observed Release	550	0
2. Potential to Release		
2a. Gas Potential to Release	500	390
2b. Particulate Potential to Release	500	110
2c. Potential to Release	500	390
3. Likelihood of Release	550	390
Waste Characteristics		
4. Toxicity/Mobility	*	1.00E+02
5. Hazardous Waste Quantity	*	100
6. Waste Characteristics	100	10
Targets		
7. Nearest Individual	50	2.00E+01
8. Population		
8a. Level I Concentrations	**	0.00E+00
8b. Level II Concentrations	**	0.00E+00
8c. Potential Contamination	**	4.80E+01
8d. Population (lines 8a+8b+8c)	**	4.80E+01
9. Resources	5	0.00E+00
10. Sensitive Environments		
10a. Actual Contamination	***	0.00E+00
10b. Potential Contamination	***	0.00E+00
10c. Sens. Environments(lines 10a+10b)	***	0.00E+00
11. Targets (lines 7+8d+9+10c)	**	6.80E+01
AIR MIGRATION PATHWAY SCORE (Sa)	100	3.21E+00

  * Maximum value applies to waste characteristics category.
 ** Maximum value not applicable.
*** No specific maximum value applies, see HRS for details.

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors DRINKING WATER THREAT	Maximum Value	Value Assigned
Likelihood of Release		
1. Observed Release	550	0
2. Potential to Release by Overland Flow		
2a. Containment	10	10
2b. Runoff	25	4
2c. Distance to Surface Water	25	0
2d. Potential to Release by Overland Flow [lines 2a(2b+2c)]	500	40
3. Potential to Release by Flood		
3a. Containment (Flood)	10	10
3b. Flood Frequency	50	7
3c. Potential to Release by Flood (lines 3a x 3b)	500	70
4. Potential to Release (lines 2d+3c)	500	110
5. Likelihood of Release	550	110
Waste Characteristics		
6. Toxicity/Persistence	*	1.00E+04
7. Hazardous Waste Quantity	*	100
8. Waste Characteristics	100	32
Targets		
9. Nearest Intake	50	0.00E+00
10. Population		
10a. Level I Concentrations	**	0.00E+00
10b. Level II Concentrations	**	0.00E+00
10c. Potential Contamination	**	0.00E+00
10d. Population (lines 10a+10b+10c)	**	0.00E+00
11. Resources	5	0.00E+00
12. Targets (lines 9+10d+11)	**	0.00E+00
13. DRINKING WATER THREAT SCORE	100	0.00

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
Doty Sand Pit - 05/19/92

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors HUMAN FOOD CHAIN THREAT	Maximum Value	Value Assigned
Likelihood of Release		
14. Likelihood of Release (same as line 5)	550	110
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	*	5.00E+07
16. Hazardous Waste Quantity	*	100
17. Waste Characteristics	1000	180
Targets		
18. Food Chain Individual	50	0.00E+00
19. Population		
19a. Level I Concentrations	**	0.00E+00
19b. Level II Concentrations	**	0.00E+00
19c. Pot. Human Food Chain Contamination	**	0.00E+00
19d. Population (lines 19a+19b+19c)	**	0.00E+00
20. Targets (lines 18+19d)	**	0.00E+00
21. HUMAN FOOD CHAIN THREAT SCORE	100	0.00

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors ENVIRONMENTAL THREAT	Maximum Value	Value Assigned
Likelihood of Release		
22. Likelihood of Release (same as line 5)	550	110
Waste Characteristics		
23. Ecosystem Toxicity/Persistence/Bioacc.	*	5.00E+08
24. Hazardous Waste Quantity	*	100
25. Waste Characteristics	1000	320
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	**	0.00E+00
26b. Level II Concentrations	**	0.00E+00
26c. Potential Contamination	**	0.00E+00
26d. Sensitive Environments (lines 26a+26b+26c)	**	0.00E+00
27. Targets (line 26d)	**	0.00E+00
28. ENVIRONMENTAL THREAT SCORE	60	0.00
29. WATERSHED SCORE	100	0.00
30. SW: OVERLAND/FLOOD COMPONENT SCORE (Sof)	100	0.00

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

No.	Segment ID	Segment Type	Water Type	Start Point (mi)	End Point (mi)	Average Flow (cfs)
1	Brays Bayou	River	Fresh	0.00	15.00	139

OBSERVED RELEASE

No. Sample ID	Sample Type	Distance (miles)	Level of Contamination		
			DW	HFC	Env

- N/A and/or data not specified

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POTENTIAL TO RELEASE

Potential to Release by Overland Flow

Containment
_____

No. Source ID	HWQ Value	Containment Value

===

	Containment Factor:	1
	Containment Factor:	2
	Containment Factor:	3

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Distance to Surface Water
─────────────────────────

Documentation for Overland Flow Containment, Source Ponded Water:

**The site contains an earthen wall around the entire site that acts
as a containment device for surface water runoff. However, the
northern wall of the containment structure has been breached
allowing water to enter the pond.**

Reference: 1

Documentation for Overland Flow Containment, Source Drum Storage Area:

**Contaminants of concern were found in the drainage pathway from the
drum storage area, thus documenting hazardous substance migration
from a source for a containment value of 10 (Ref 1, Table 3-2, Sec
3.1.2.1).**

Reference: 1

Documentation for Overland Flow Containment, Source Old Landfill:

**An earthen wall surrounds the entire Doty Sand facility. This wall
acts as a containment device. The wall was breached at the active
landfill area but not at the old landfill area.**

Reference: 14

Distance to Surface Water Factor: 0

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Runoff

Documentation for Distance to Surface Water:

    The overland flow segment consists of 3 drainage ditches that
    drain the site and enter an unnamed canal north of the site. The
    canal then enters Brays Bayou approximately 2.7 miles downstream of
    the canal and flows in a easterly direction for 20 miles until it
    enters the Houston Ship Channel . The east drainage ditch borders
    the eastern portion of the site and flows in a northerly direction
    paralling(b) (6)   . It enters the canal at the point where the
    canal enters an underground culvert system. The west drainage ditch
    parallels the site and (b) (6)   and flows in a northerly direction.
    It enters the canal northwest of the site. The north drainage ditch
    parallels the old wastewater treatment plant and the site and flows
    in a westerly direction until it enters the west drainage ditch.

    The distance to the nearest perennial Surface Water Body:
            1 mile= 5,280 feet
        2.7 miles X 5,280 feet= 14,256

Reference: 3

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Documentation for Drainage Area:

    Drainage area for the sources is 125 acres. Based on the topography
    of the site, drainage from any location on site could flow to one of
    the four sources (Ref. 3).

Reference: 3

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Documentation for Rainfall:

The two year, 24-hour rainfall for the vicinity is 5 inches (Ref.
4).

Reference: 4

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Documentation for Soil Group:

The predominant surface soil in the area is of the Bernard-Edna
complex which consists of a clay loam, poorly drained and low
permeability (Ref. 5, pp.12, 48, 49).

Reference: 5

===

Potential to Release by Overland Flow Factor: 4

Potential to Release by Flood

No.	Source ID	HWQ Value	Flood Containment Value	Flood Frequency Value	Potential to Release by Flood
40	˥♣ë→»↑η●	6.01E-154	5888	14840	3906

===

Potential to Release by Flood Factor: 1
Potential to Release by Flood Factor: 2
Potential to Release by Flood Factor: 3

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Documentation for Flood Containment, Source Ponded Water:

The site is not known to be certified for adequate flood control by a professional engineer, however, the site is in the 500-year flood plain (Ref. 6).

Reference: 6

Documentation for Flood Frequency, Source Ponded Water:

The site is in a 500-year floodplain (Ref. 6).

Reference: 6

Documentation for Flood Containment, Source Drum Storage Area:

The site is not known to be certified for adequate flood control by a professional engineer, however, the site is in a 500-year flood plain (Ref. 6).

Reference: 6

Documentation for Flood Frequency, Source Drum Storage Area:

The site is in a 500-year flood plain (Ref. 6).

Reference: 6

Documentation for Flood Containment, Source Old Landfill:

The earthen wall acts as a flood containment structure; however, no documentation concerning enigneered certification has been located.

Reference: 14

Documentation for Flood Frequency, Source Old Landfill:

According to Flood Insurance maps of the study area, the site does lie in a 500-year floodplain.

Reference: 6

Source: 1 Ponded Water

Source Hazardous Waste Quantity Value: 185.20

Hazardous Substance	Toxicity Value	Persistence Value	Toxicity/ Persistence Value
Barium	10000	1.00E+00	1.00E+04
Benzene	100	4.00E-01	4.00E+01
Bis (2-ethylhexyl) phthalate	100	1.00E+00	1.00E+02
Cadmium	10000	1.00E+00	1.00E+04
Chromium	10000	1.00E+00	1.00E+04
Copper	100	1.00E+00	1.00E+02
Lead	10000	1.00E+00	1.00E+04
Manganese	10000	1.00E+00	1.00E+04

Doty Sand Pit - 05/19/92

Source: 2   Drum Storage Area

Source Hazardous Waste Quantity Value: 0.15

Hazardous Substance	Toxicity Value	Persistence Value	Toxicity/ Persistence Value
Acenaphthylene	0	1.00E+00	0.00E+00
Anthracene	10	4.00E-01	4.00E+00
Benz(a)anthracene	1000	1.00E+00	1.00E+03
Benzo(a)pyrene	10000	1.00E+00	1.00E+04
Benzo(j,k)fluorene	100	1.00E+00	1.00E+02
Chrysene	0	1.00E+00	0.00E+00
Cobalt	100	1.00E+00	1.00E+02
Copper	100	1.00E+00	1.00E+02
Fluorene	100	1.00E+00	1.00E+02
Iron	0	1.00E+00	0.00E+00
Lead	10000	1.00E+00	1.00E+04
Manganese	10000	1.00E+00	1.00E+04
Phenanthrene	1	4.00E-01	4.00E-01
Toluene	10	4.00E-01	4.00E+00
Zinc	10	1.00E+00	1.00E+01

Source: 3   Old Landfill

Source Hazardous Waste Quantity Value: 1409.29

Hazardous Substance	Toxicity Value	Persistence Value	Toxicity/ Persistence Value

Hazardous Substances Found in an Observed Release

Sample No.	Observed Release Hazardous Substance	Toxicity Value	Persistence Value	Toxicity/ Persistence Value

- N/A and/or data not specified

Toxicity/Persistence Value from Source Hazardous Substances: 1.00E+04

Toxicity/Persistence Value from Observed Release Hazardous
Substances: 0.00E+00

Toxicity/Persistence Factor: 1.00E+04

Sum of Source Hazardous Waste Quantity Values: 1.59E+03

Hazardous Waste Quantity Factor: 100

Waste Characteristics Factor Category: 32

Level I Concentrations

- N/A and/or data not specified

Level II Concentrations

- N/A and/or data not specified

Most Distant Level I Sample
_____

- N/A and/or data not specified

Most Distant Level II Sample
_____

- N/A and/or data not specified

Level I Concentrations
_____

Intake	Distance Along the In-water Segment from the Probable Point of Entry (miles)	Population
- N/A and/or data not specified		

==

Population Served by Level I Intakes: 0.0

Level I Population Factor: 0.00E+00

Level II Concentrations
_____

| | Distance Along the In-water Segment from the | |
Intake	Probable Point of Entry (miles)	Population
- N/A and/or data not specified		

==

Population Served by Level II Intakes: 0.0

Level II Population Factor: 0.00E+00

Potential Contamination

Intake ID	Average Annual Flow (cfs)	Population Served

- N/A and/or data not specified

Type of Surface Water Body	Total Population	Dilution-Weighted Population

- N/A and/or data not specified

===

Dilution-Weighted Population Served
by Potentially Contaminated Intakes: 0.0

                          Potential Contamination Factor: 0.0

Nearest Intake

Location of Nearest Drinking Water Intake: N.A.

Nearest Intake Factor: 0.00

Resources

Resource Use: NO

Resource Value: 0.00E+00

Documentation for Resources:

   There were no surface water intakes identified for irrigation of
   commercial food crops, silviculture or commericial livestock within
   the 15 mile downstream target distance (Ref. 3, Ref. 7). However,
   several intakes were identified as irrigation sources for several
   golf courses (Ref. 3, Ref. 7).

Reference: 3, 7

Source: 1   Ponded Water

Source Hazardous Waste Quantity Value: 185.20

Hazardous Substance	Toxicity Value	Persistence Value	Bio-accum. Value	Toxicity/ Persistence/ Bioaccum. Value
Barium	10000	1.00E+00	5.00E-01	5.00E+03
Benzene	100	4.00E-01	5.00E+03	2.00E+05
Bis (2-ethylhexyl) phthalate	100	1.00E+00	5.00E+03	5.00E+05
Cadmium	10000	1.00E+00	5.00E+03	5.00E+07
Chromium	10000	1.00E+00	5.00E+02	5.00E+06
Copper	100	1.00E+00	5.00E+04	5.00E+06
Lead	10000	1.00E+00	5.00E+03	5.00E+07
Manganese	10000	1.00E+00	5.00E+03	5.00E+07

Source: 2   Drum Storage Area

Source Hazardous Waste Quantity Value: 0.15

Hazardous Substance	Toxicity Value	Persistence Value	Bio-accum. Value	Toxicity/ Persistence/ Bioaccum. Value
Acenaphthylene	0	1.00E+00	5.00E+02	0.00E+00
Anthracene	10	4.00E-01	5.00E+03	2.00E+04
Benz(a)anthracene	1000	1.00E+00	5.00E+04	5.00E+07
Benzo(a)pyrene	10000	1.00E+00	5.00E+02	5.00E+06
Benzo(j,k)fluorene	100	1.00E+00	5.00E-01	5.00E+01
Chrysene	0	1.00E+00	5.00E+02	0.00E+00
Cobalt	100	1.00E+00	5.00E+03	5.00E+05
Copper	100	1.00E+00	5.00E+04	5.00E+06
Fluorene	100	1.00E+00	5.00E+03	5.00E+05
Iron	0	1.00E+00	5.00E-01	0.00E+00
Lead	10000	1.00E+00	5.00E+03	5.00E+07
Manganese	10000	1.00E+00	5.00E+03	5.00E+07
Phenanthrene	1	4.00E-01	5.00E+01	2.00E+01
Toluene	10	4.00E-01	5.00E+01	2.00E+02
Zinc	10	1.00E+00	5.00E+04	5.00E+05

Source: 3 Old Landfill

Source Hazardous Waste Quantity Value: 1409.29

Hazardous Substance	Toxicity Value	Persistence Value	Bio-accum. Value	Toxicity/ Persistence/ Bioaccum. Value

Hazardous Substances Found in an Observed Release

Sample No.	Observed Release Hazardous Substance	Toxicity Value	Persistence Value	Bio-accum. Value	Toxicity/ Persistence/ Bioaccum. Value

- N/A and/or data not specified

Toxicity/Persistence/Bioaccumulation Value from Source Hazardous
Substances: 5.00E+07

Toxicity/Persistence/Bioaccumulation Value from Observed Release
Hazardous Substances: 0.00E+00

Toxicity/Persistence/Bioaccumulation Factor: 5.00E+07

Sum of Source Hazardous Waste Quantity Values: 1.59E+03

Hazardous Waste Quantity Factor: 100

Waste Characteristics Factor Category: 180

Level I Concentrations

- N/A and/or data not specified

Level II Concentrations

- N/A and/or data not specified

Most Distant Level I Sample
_____

- N/A and/or data not specified

Most Distant Level II Sample
_____

- N/A and/or data not specified

Level I Concentrations

Fishery	Annual Production (pounds)	Human Food Chain Population Value
- N/A and/or data not specified		

==

Sum of Human Food Chain Population Values: 0.00E+00

Level I Concentrations Factor: 0.00E+00

Level II Concentrations

Fishery	Annual Production (pounds)	Human Food Chain Population Value
- N/A and/or data not specified		

==

Sum of Human Food Chain Population Values: 0.00E+00

Level II Concentrations Factor: 0.00E+00

Potential Contamination

Fishery	Annnual Production (pounds)	Type of Surface Water Body	Average Annual Flow (cfs)	Pop. Value (Pi)	Dilution Weight (Di)	Pi*Di
- N/A and/or data not specified						

==

Sum of (Pi*Di): 0.00E+00

Potential Human Food Chain Contamination Factor: 0.00E+00

Documentation for Brays Bayou Fishery:

**There are no documented commercial fisheries, but it is possible to
fish from Brays Bayou located approximately 2.7 miles east of the
site (Ref. 3)**

Reference: 3

Food Chain Individual
_____

Location of Nearest Fishery: N.A.

Food Chain Individual Factor: 0.00

Source: 1   Ponded Water

Source Hazardous Waste Quantity Value: 185.20

Hazardous Substance	Eco-toxicity Value	Persistence Value	Bio-accum. Value	Ecotoxicity/ Persistence/ Bioaccum. Value
Barium	1	1.00E+00	5.00E-01	5.00E-01
Benzene	10000	4.00E-01	5.00E+04	2.00E+08
Bis (2-ethylhexyl) phthalate	1000	1.00E+00	5.00E+04	5.00E+07
Cadmium	1000	1.00E+00	5.00E+03	5.00E+06
Chromium	10	1.00E+00	5.00E+02	5.00E+03
Copper	1000	1.00E+00	5.00E+04	5.00E+07
Lead	1000	1.00E+00	5.00E+03	5.00E+06
Manganese	0	1.00E+00	5.00E+04	0.00E+00

Source: 2   Drum Storage Area

Source Hazardous Waste Quantity Value: 0.15

Hazardous Substance	Eco-toxicity Value	Persistence Value	Bio-accum. Value	Ecotoxicity/ Persistence/ Bioaccum. Value
Acenaphthylene	0	1.00E+00	5.00E+02	0.00E+00
Anthracene	10000	4.00E-01	5.00E+03	2.00E+07
Benz(a)anthracene	10000	1.00E+00	5.00E+04	5.00E+08
Benzo(a)pyrene	1000	1.00E+00	5.00E+02	5.00E+05
Benzo(j,k)fluorene	0	1.00E+00	5.00E-01	0.00E+00
Chrysene	0	1.00E+00	5.00E+02	0.00E+00
Cobalt	0	1.00E+00	5.00E+03	0.00E+00
Copper	1000	1.00E+00	5.00E+04	5.00E+07
Fluorene	1000	1.00E+00	5.00E+03	5.00E+06
Iron	10	1.00E+00	5.00E-01	5.00E+00
Lead	1000	1.00E+00	5.00E+03	5.00E+06
Manganese	0	1.00E+00	5.00E+04	0.00E+00
Phenanthrene	1000	4.00E-01	5.00E+01	2.00E+04
Toluene	100	4.00E-01	5.00E+01	2.00E+03
Zinc	100	1.00E+00	5.00E+04	5.00E+06

Source: 3 Old Landfill

Source Hazardous Waste Quantity Value: 1409.29

Hazardous Substance	Eco-toxicity Value	Persistence Value	Bio-accum. Value	Ecotoxicity/ Persistence/ Bioaccum. Value

Hazardous Substances Found in an Observed Release

Sample No.	Observed Release Hazardous Substance	Eco-toxicity Value	Persistence Value	Bio-accum. Value	Ecotoxicity/ Persistence/ Bioaccum. Value

- N/A and/or data not specified

Ecotoxicity/Persistence/Bioaccummulation Value from Source
Hazardous Substances: 5.00E+08

Ecotoxicity/Persistence/Bioaccummulation Value from Observed
Release Hazardous Substances: 0.00E+00

Ecotoxicity/Persistence/Bioaccummulation Factor: 5.00E+08

Sum of Source Hazardous Waste Quantity Values: 1.59E+03

Hazardous Waste Quantity Factor: 100

Waste Characteristics Factor Category: 320

Level I Concentrations

  - N/A and/or data not specified

Level II Concentrations

  - N/A and/or data not specified

Most Distant Level I Sample
_____

  - N/A and/or data not specified

Most Distant Level II Sample
_____

  - N/A and/or data not specified

Level I Concentrations

Sensitive Environment	Distance from Probable Point of Entry to Sensitive Env. (miles)	Sensitive Environment Value
- N/A and/or data not specified		

Sum of Sensitive Environments Values: 0

Wetlands

Wetland	Distance from Probable Point of Entry to Wetland (miles)	Wetlands Frontage (miles)
- N/A and/or data not specified		

Total Wetlands Frontage: 0.00 Miles   Total Wetlands Value: 0

===
Sum of Sensitive Environments Value + Wetlands Value: 0.00E+00

Level I Concentrations Factor: 0.00E+00

Level II Concentrations

Sensitive Environment	Distance from Probable Point of Entry to Sensitive Env. (miles)	Sensitive Environment Value
- N/A and/or data not specified		

Sum of Sensitive Environments Values: 0

Wetlands

Wetland	Distance from Probable Point of Entry to Wetland (miles)	Wetlands Frontage (miles)
- N/A and/or data not specified		

Total Wetlands Frontage: 0.00 Miles   Total Wetlands Value: 0

===

Sum of Sensitive Environments Value + Wetlands Value: 0.00E+00

Level II Concentrations Factor: 0.00E+00

Potential Contamination

Sensitive Environments

Type of Surface Water Body	Sensitive Environment	Sensitive Environment Value	

Wetlands

Type of Surface Water Body	Sensitive Environment	Wetlands Frontage	Wetlands Value

- N/A and/or data not specified

Type of Surface Water Body	Sum of Sens. Environment Values(S_j)	Sum of Wetland Frontage Values(W_j)	Dilution Weight (D_j)	$D_j(W_j+S_j)$

- N/A and/or data not specified

	Sum of $D_j(W_j+S_j)$:	0.00E+00
	Sum of $D_j(W_j+S_j)/10$:	0.00E+00

==

Potential Contamination Sensitive Environment Factor: 0.00E+00

GROUND WATER MIGRATION PATHWAY Factor Categories & Factors	Maximum Value	Value Assigned
Likelihood of Release to an Aquifer Aquifer: Lower Chicot		
1. Observed Release	550	0
2. Potential to Release		
2a. Containment	10	10
2b. Net Precipitation	10	3
2c. Depth to Aquifer	5	5
2d. Travel Time	35	35
2e. Potential to Release		
[lines 2a(2b+2c+2d)]	500	430
3. Likelihood of Release	550	430
Waste Characteristics		
4. Toxicity/Mobility	*	1.00E+04
5. Hazardous Waste Quantity	*	100
6. Waste Characteristics	100	32
Targets		
7. Nearest Well	50	2.00E+01
8. Population		
8a. Level I Concentrations	**	0.00E+00
8b. Level II Concentrations	**	0.00E+00
8c. Potential Contamination	**	4.00E+00
8d. Population (lines 8a+8b+8c)	**	4.00E+00
9. Resources	5	5.00E+00
10. Wellhead Protection Area	20	5.00E+00
11. Targets (lines 7+8d+9+10)	**	3.40E+01
12. Targets (including overlaying aquifers)	**	2.61E+02
13. Aquifer Score	100	43.53
GROUND WATER MIGRATION PATHWAY SCORE (Sgw)	100	43.53

 * Maximum value applies to waste characteristics category.
** Maximum value not applicable.

No.	Aquifer ID	Type	Overlaying No.	Inter-Connected with	Likelihood of Release	Targets
1	Evangeline	Non K	0	0	430	2.46E+02
2	Lower Chicot	Non K	1	1	430	2.61E+02
3	Upper Chicot	Non K	2	2	430	2.61E+02

Containment

No.	Source ID	HWQ Value	Containment Value
1	Ponded Water	1.85E+02	10
2	Drum Storage Area	1.47E-01	10
3	Old Landfill	1.41E+03	10

===
Containment Factor   10

Documentation for Ground Water Containment, Source Ponded Water:

There is no documentation to indicate that the pond has a liner, so the maximum score for containment is assumed (Ref. 14).

Reference: 14

Documentation for Ground Water Containment, Source Drum Storage Area:

During the on-site reconnaissance inspection, the FIT noted approximately 40 drums in various states of condition and an area of stained soil. No containment system was evident near the drums (Ref. 14, Appendix A). During the SSI of January 1991, one month following the reconnaissance inspection, the FIT noted that the drums had been removed from this area and bulldozers were moving the soils around in the previously stained area (Ref. 14, Appendix B).

Reference: 14

Documentation for Ground Water Containment, Source Old Landfill:

> **There is no documentation to indicate that ground water containment devices were utilized at this source area. It is highly unlikely that engineered containment devices exist due to the time period that the landfill was being operated (1958).**

Reference: 14

Net Precipitation
_____

     Net Precipitation (inches)   11.00

Documentation for Net Precipitation:

> **The net precipitation value for the Houston area is mapped as 3(Ref. 1, Figure 3-2, Sec. 3.1.2.2). The actual precipitation is approximately 11 inches (Ref. 16).**

Reference: 1, 16

Aquifer: Evangeline

Type of Aquifer: Non Karst

Overlaying Aquifer: 0

Interconnected with: 0

Documentation for Evangeline   Aquifer:

    The Evangeline aquifer consists of layers of sand and clay of the
    Goliad Sand Formation and the Fleming Formation (Ref. 14)
    No ground water samples were taken, so an observed release to ground
    water cannot be documented.

Reference: 14

OBSERVED RELEASE

| | | | Distance | |
No.	Well ID	Well Type	(miles)	Level of Contamination

    - N/A and/or data not specified

==

                                    Observed Release Factor   0

Documentation for Well (b) (9)   :

    Well(b) (9) is currently used by the (b) (9)   as a
    drinking well. It has approximately 1,340 connections (Ref.19). The
    average population per household in Houston is 2.66 (Ref. 11), so
    the caluculated approximate population served by the well is 3,564.

Reference: 11, 19

Documentation for Well (b) (9)

This well was identified as being operated by the (b) (9)
(b) (9)   The well taps the Evangeline Aquifer. The number of
connections served by this well is not known.

Reference: 14

Documentation for Well (b) (9)   :

A municipal well located approximately (b) (9)   of the
site, in Fort Bend County, is operated by the (b) (9)   This
well serves 147 connections or approximately 391 people.

Reference: 3, 14

Documentation for Well (b) (9)   :

(b) (9)   operates a well that taps the Evangelin Aquifer. The
well is located approximately (b) (9)   of the site and
is not part of a blended system. The well serves approximately 444
connections or approximately 1,181 people.

Reference: 3, 14

Documentation for Well (b) (9)

(b) (9)   operates a well that taps the Evangeline
Aquifer, which is located approximately (b) (9)   (b) (9)   of the
site. The well serves approximately 1,700 connections or 4,522
people.

Reference: 3, 14

Documentation for Well ████████████████████████

████████████████████████, also known as the ████████ well is located
approximately ████████████████ of the site. The well serves
approximately 2,000 connections or 5,320 people.

Reference: 3, 14

POTENTIAL TO RELEASE

Containment
_____

   Containment Factor   10

Net Precipitation
_____

   Net Precipitation Factor   3

Depth to Aquifer
_____

   A.   Depth of Hazardous Substances   5.00   feet

Documentation for Depth of Hazardous Substances:

   The size of the pond is estimated to be 50 x 50 feet, with a depth
   of 3 to 5 feet. Data analysis indicated the presence of metals,
   VOAs and semi-volatile organics in the pond water and sediment
   samples (Ref. 14).

Reference: 14

   B.   Depth to Aquifer from Surface   9.00   feet

Documentation for Depth to Aquifer from Surface :

   According to the digital model for the Evangeline aquifer, ground
   water is encountered at approximately 600 feet (Ref. 17). However,
   the Chicot Aquifer system and the Evangeline are considered to
   hydrologically interconnected. The depth to the Upper Chicot is 9
   feet; therefore, depth to aquifer for the Evangeline Aquifer is
   evaluated using the Upper Chicot.

Reference: 1, 12, 14, 17

C.   Depth to Aquifer (B - A)   4.00   feet

Depth to Aquifer Factor   5

Travel Time
────────────

Are All Layers Karst?   NO

Documentation for Karst Layers:

   **The U.S. Geological Service Soil Survey for Harris County did not
   indicate that the area has Karst terrain (Ref. 5).**

Reference: 5

Thickness of Layer(s) with Lowest Conductivity   0.00   feet

Documentation for Thickness of Layers with Lowest Conductivity:

   **The Evangeline aquifer consists of layers of sand, shale and clay
   The Evangeline Aquifer is interconnected to the Chicot Aquifer
   system. Due to the interconnection between the Chicot Aquifer and
   the Evangeline Aquifer this section will not be evaluated.**

Reference: 1, 14, 17

Hydraulic Conductivity (cm/sec)   0.0E-00

Documentation for Hydraulic Conductivity:

   **Due to the interconnection of the Chicot and Evangeline Aquifers,
   this section will not be evaluated.**

Reference: 1, 14, 17

Travel Time Factor   35

===

                          Potential to Release Factor   430

Aquifer: Lower Chicot

Type of Aquifer: Non Karst

Overlaying Aquifer: 1

Interconnected with: 1

Documentation for Lower Chicot Aquifer:

   The Lower Chicot consists of sand and clay layers of the Willis Sand
   Formation. The Lower Chicot extends to a depth of approximately 900
   feet at the site location (Ref 14).
   No ground water samples were taken, so an observed release to the
   ground water cannot be documented.

Reference: 14

OBSERVED RELEASE

No.	Well ID	Well Type	Distance (miles)	Level of Contamination

   - N/A and/or data not specified

===
                                    Observed Release Factor   0

Documentation for Well (b) (9)

   (b) (9)   operates a well, 573 feet deep that taps the
   Chicot Aquifer. The well serves 317 connections or approximately
   843 people.

Reference: 3, 14

POTENTIAL TO RELEASE

Containment
────────────────────

   Containment Factor   10

Net Precipitation
────────────────────

   Net Precipitation Factor   3

Depth to Aquifer
────────────────────

  A.   Depth of Hazardous Substances   5.00   feet

Documentation for Depth of Hazardous Substances:

   The size of the pond was estimated to be 50 x 50 feet. The depth
   of the pond was estimated to be 3 to 5 feet (Ref. 14, Appendix A).
   Data analyses indicated the presence of metals, VOAs and
   semi-volatile organics in the pond water and sediment samples (Ref.
   14).

Reference: 14

  B.   Depth to Aquifer from Surface   9.00   feet

Documentation for Depth to Aquifer from Surface :

   Depth to Upper Chicot Aquifer is found approximately 9 feet below
   the land surface, according to a City of Bissonnet Well Log #1. The
   Upper and Lower Units of the Chicot Aquifer are considered to be
   interconnected. Therefore, distance to the Upper Chicot will be
   used to determine the depth to aquifer for the Lower Chicot.

Reference: 14, 24

C. Depth to Aquifer (B - A)   4.00   feet

Depth to Aquifer Factor   5

Travel Time
_____

Are All Layers Karst?   NO

Documentation for Karst Layers:

     The U.S. Soil Conservation Survery for Harris County did not
     indicated that Karst terrain was present in the area (Ref. 5).

Reference: 5

Thickness of Layer(s) with Lowest Conductivity   0.00   feet

Documentation for Thickness of Layers with Lowest Conductivity:

     Due to the interconnection of the Chicot and Evangeline
     Aquifers, this section will not be evaluated.

Reference: 1, 3, 17

Hydraulic Conductivity (cm/sec)   0.0E-00

Documentation for Hydraulic Conductivity:

     Due to the interconnection of the Chicot and Evangeline Aquifers,
     this section will not be evaluated.

Reference: 1, 14, 17

Travel Time Factor   35

===

                        Potential to Release Factor   430

Aquifer: Upper Chicot

Type of Aquifer: Non Karst

Overlaying Aquifer: 2

Interconnected with: 2

Documentation for Upper Chicot Aquifer:

**The most shallow aquifer is the Upper Chicot which is made up of
discontinuous layers of sand and clay from the Beaumont Clay
formation (Ref. 14)
No ground water samples were taken, so an observed release to the
ground water cannot be documented.**

Reference: 14

OBSERVED RELEASE

No.	Well ID	Well Type	Distance (miles)	Level of Contamination
- N/A and/or data not specified				

===

Observed Release Factor   0

POTENTIAL TO RELEASE

Containment
_____

    Containment Factor   10

Net Precipitation
_____

    Net Precipitation Factor   3

Depth to Aquifer
_____

    A.   Depth of Hazardous Substances   5.00   feet

Documentation for Depth of Hazardous Substances:

    **The size of the pond was estimated to be 50 x 50 feet, with and
    estimated depth of 3 to 5 feet. Data analysis indicated the
    presence of metals in the pond water, and semi-volatile organics in
    the pond sediment (Ref. 14).**

Reference: 14

    B.   Depth to Aquifer from Surface   9.00   feet

Documentation for Depth to Aquifer from Surface :

    **Depth to the Upper Unit of the Chicot Aquifer is approximately
    9 feet, according to the City of Bissonnet Well Log #1.**

Reference: 12

    C.   Depth to Aquifer (B - A)   4.00   feet

Depth to Aquifer Factor   5

Travel Time
_____

Are All Layers Karst?   NO

Documentation for Karst Layers:

    **The U.S. Soil Conservation Service Soil Survey for Harris County did
not indicate the presence of Karst terrain in the area (Ref. 5).**

Reference: 5

Thickness of Layer(s) with Lowest Conductivity   0.00   feet

Documentation for Thickness of Layers with Lowest Conductivity:

    **In some parts of the coastal area, the Chicot Aquifer can be
separated into an upper and lower unit. If the upper unit cannot be
defined, the aquifer is said to be undifferentiated. The Chicot
aquifer is composed of discontinuous layers of sand and clay. The
thickness of the aquifer is approximately 600 feet (Ref. 3, Ref. 17).**

    **According to a Well log for the Bissonnet MUD Well #1, the first
layer encountered is a sand layer approximately 38 feet in thickness.**

Reference: 3, 17, 24

Hydraulic Conductivity (cm/sec)   0.0E-00

Documentation for Hydraulic Conductivity:

   **The Upper Chicot Aquifer can be found at a depth of 9 feet below the
   surface. Due to the depth to aquifer being less than 25 feet, this
   section will not be evaluated.**

Reference: 1, 14, 17

   Travel Time Factor   35

===
                        Potential to Release Factor   430

Source: 1 Ponded Water

Source Hazardous Waste Quantity Value: 185.20

Hazardous Substance	Toxicity Value	Mobility Value	Toxicity/ Mobility Value
Barium	10000	1.00E-02	1.00E+02
Benzene	100	1.00E+00	1.00E+02
Bis (2-ethylhexyl) phthalate	100	1.00E-04	1.00E-02
Cadmium	10000	1.00E+00	1.00E+04
Chromium	10000	1.00E-02	1.00E+02
Copper	100	1.00E-02	1.00E+00
Lead	10000	2.00E-05	2.00E-01
Manganese	10000	1.00E-02	1.00E+02

Source: 2   Drum Storage Area

Source Hazardous Waste Quantity Value: 0.15

Hazardous Substance	Toxicity Value	Mobility Value	Toxicity/ Mobility Value
Acenaphthylene	100	2.00E-03	2.00E-01
Anthracene	10	2.00E-07	2.00E-06
Benz(a)anthracene	1000	2.00E-09	2.00E-06
Benzo(a)pyrene	10000	2.00E-09	2.00E-05
Benzo(j,k)fluorene	100	2.00E-05	2.00E-03
Chrysene	100	2.00E-09	2.00E-07
Cobalt	100	1.00E-02	1.00E+00
Copper	100	1.00E-02	1.00E+00
Fluorene	100	2.00E-03	2.00E-01
Iron	100	1.00E-02	1.00E+00
Lead	10000	2.00E-05	2.00E-01
Manganese	10000	1.00E-02	1.00E+02
Phenanthrene	1	2.00E-05	2.00E-05
Toluene	10	1.00E-02	1.00E-01
Zinc	10	2.00E-03	2.00E-02

Source: 3 Old Landfill

Source Hazardous Waste Quantity Value: 1409.29

Hazardous Substance	Toxicity Value	Mobility Value	Toxicity/ Mobility Value

Hazardous Substances Found in an Observed Release

Well No.	Observed Release Hazardous Substance	Toxicity Value	Mobility Value	Toxicity/ Mobility Value

- N/A and/or data not specified

PREscore 1.0 - PRESCORE.TCL File 12/23/91
GROUND WATER PATHWAY WASTE CHARACTERISTICS
Doty Sand Pit - 05/19/92

PAGE: 23

Toxicity/Mobility Value from Source Hazardous Substances: 1.00E+04

Toxicity/Mobility Value from Observed Release Hazardous
Substances: 0.00E+00

Toxicity/Mobility Factor: 1.00E+04

Sum of Source Hazardous Waste Quantity Values: 1.59E+03

Hazardous Waste Quantity Factor: 100

Waste Characteristics Factor Category: 32

Population by Well

No.	Well ID	Sample Type	Distance (miles)	Level of Contamination	Population

- N/A and/or data not specified

Level I Population Factor: 0.00

Level II Population Factor: 0.00

Potential Contamination by Distance Category

Distance Category (miles)	Population	Value
> 0 to 1/4	0.0	0.00E+00
> 1/4 to 1/2	0.0	0.00E+00
> 1/2 to 1	0.0	0.00E+00
> 1 to 2	3564.0	9.39E+01
> 2 to 3	391.0	6.80E+00
> 3 to 4	11023.0	1.31E+02

Potential Contamination Factor: 231.000

Documentation for Target Population > 0 to 1/4 mile Distance Category:

**There were no drinking municipal drinking water wells identified
within 1/4 mile of the site.**

Reference: 3

Documentation for Target Population > 1/4 to 1/2 mile Distance Category:

**There were no municipal drinking water wells identified within 1/4
to 1/2 mile of the site.**

Reference: 3

Documentation for Target Population > 1/2 to 1 mile Distance Category:

**There were no municipal drinking water wells identified within 1/2
to 1 mile of the site.**

Reference: 3, 12

Documentation for Target Population > 1 to 2 miles Distance Category:

    There is no documented drinking water usage from the Upper and
    Lower Units of the Chicot Aquifer; thus, all drinking
    water is obtained from the Evangeline Aquifer. To calculate
    the number of people utilizing drinking water within the 1 to 2
    mile radius, the GEMS database will be used. Approximately
    41,353 people reside within the 1 to 2 mile radius.

Reference: 7, 11, 15, 17, 19

Documentation for Target Population > 2 to 3 miles Distance Category:

    Well (b) (9) has approximately 1,700 connections (Ref. 20), and Well
    (b) (9) has approximately 444 connections (Ref. 19). Well (b) (9) is
    located approximately (b) (9)   from the site (Ref. 17), and well #
    (b) (9) is located approximatley (b) (9)   from the site (Ref. 17). Since
    the average population per household in Houston is 2.66 (Ref. 11),
    the wells serve a combined population of 6,713 people.

Reference: 11, 17, 19, 20

Documentation for Target Population > 3 to 4 miles Distance Category:

    Well(b) (9)   is located approximately (b) (9)   from the site (Ref.
    17), and has approximately 2,000 connections (Ref. 21). Since the
    average population per household in Houston is 2.66 (Ref. 11), the
    well serves approximately 5,320 people.

Reference: 11, 21

Nearest Well
_____

Level of Contamination: Potential
Distance in miles: 1.50

Nearest Well Factor: 5.00E+00

Documentation for Nearest Well:

The nearest well drawing from the Evangeline Aquifer is (b) (9)
(b) (9)   , located approximately (b) (9)   of the site
(Ref. 3, Ref. 14). The City of Houston is on a blended system of
surface water and ground water, but the west side of Houston is on
100% ground water. It was not possible to determine the exact
number of people served by the wells in question (Ref. 14).

Reference: 3, 12

Resources
_____

Resource Use: YES

Resource Factor: 5.00E+00

Documentation for Resources:

Fame City Water Works, a water amusement park, is located
approximately 1.5 miles west of the site, and is served by a
well. The well is located north of (b) (9)   , and (b) (9)
Well (b) (9) (Ref. 19).

Reference: 19

Wellhead Protection Area
_____

There is a designated wellhead protection area

Wellhead Protection Area Factor: 5.00E+00

Documentation for Wellhead Protection Area:

   The City of Houston has implemented a Wellhead Protection Program.
   Houston's municipal wells have an exclusion radii of at least 1/4
   mile (Ref. 13, Ref. 14).

Reference: 13, 14

Population by Well

No.	Well ID	Sample Type	Distance (miles)	Level of Contamination	Population
	- N/A and/or data not specified				

Level I Population Factor: 0.00

Level II Population Factor: 0.00

Potential Contamination by Distance Category

Distance Category (miles)	Population	Value
> 0 to 1/4	0.0	0.00E+00
> 1/4 to 1/2	0.0	0.00E+00
> 1/2 to 1	0.0	0.00E+00
> 1 to 2	0.0	0.00E+00
> 2 to 3	0.0	0.00E+00
> 3 to 4	843.0	4.20E+00

Potential Contamination Factor: 4.000

Documentation for Target Population > 0 to 1/4 mile Distance Category:

There is no documented usage of the driniking water wells drawing
from the Chicot Aquifer within 0 to 3 miles of the site. One well
that is operated by the (b) (9)   was identified
approximately (b) (9)   of the site.

Reference: 3, 14

Documentation for Target Population > 3 to 4 miles Distance Category:

One well that taps the Chicot Aquifer was identified (b) (9)
(b) (9)   of the site. The well is operated by the (b) (9)
(b)(9) and is approximately 573 feet deep. The well serves
approximately 317 connections or 843 people.

Reference: 3, 14

Nearest Well

Level of Contamination: Potential

Distance in miles: 0.00

Nearest Well Factor: 2.00E+01

Documentation for Nearest Well:

    There is no documentation to indicate that any well tapping the
    Lower Unit of the Chicot Aquifer, lies within 4 miles of the site.

Reference:

Resources
_____

Resource Use: YES

Resource Factor: 5.00E+00

Documentation for Resources:

    There are several wells within a 1 mile radius of the site (Ref.
    12). It is possible that they are used for irrigation purposes.

Reference: 12

Wellhead Protection Area
_____

There is a designated wellhead protection area

Wellhead Protection Area Factor: 5.00E+00

Documentation for Wellhead Protection Area:

   The City of Houston has implemented a Wellhead Protection Program.
   Houston's mucicipal wells have an exclusion radii of at least 1/4
   mile. (Ref. 2)

Reference: 2

Population by Well
_____

No.	Well ID	Sample Type	Distance (miles)	Level of Contamination	Population

- N/A and/or data not specified

Level I Population Factor: 0.00

Level II Population Factor: 0.00

Potential Contamination by Distance Category

Distance Category (miles)	Population	Value
> 0 to 1/4	0.0	0.00E+00
> 1/4 to 1/2	0.0	0.00E+00
> 1/2 to 1	0.0	0.00E+00
> 1 to 2	0.0	0.00E+00
> 2 to 3	0.0	0.00E+00
> 3 to 4	0.0	0.00E+00

Potential Contamination Factor: 0.000

Documentation for Target Population > 0 to 1/4 mile Distance Category:

> **There is no documentation of any municipal drinking water wells tapping the Upper Unit of the Chicot Aquifer within 4 miles of the site.**

Reference:

Nearest Well

Level of Contamination: N.A.

Nearest Well Factor: 0.00E+00

Documentation for Nearest Well:

> **The nearest drinking water well identified that taps the Upper Unit of the Chicot Aquifer is approximately 3.5 northwest of the site.**

Reference: 3, 14

Resources

Resource Use: NO

Resource Factor: 0.00E+00

Documentation for Resources:

No resources identified.

Reference:

Wellhead Protection Area

There is a designated wellhead protection area

Wellhead Protection Area Factor: 5.00E+00

Documentation for Wellhead Protection Area:

**The City of Houston has implemented a Wellhead Protection Program.
Houston's municipal wells have an exclusion radii of at least 1/4
mile; however, and observed release has not been documented to the
ground water pathway (Ref. 2).**

Reference: 2

Record Information

1. Site Name: Doty Sand Pit
   (as entered in CERCLIS)

2. Site CERCLIS Number: TXD000327726

3. Site Reviewer: Alex Zocchi

4. Date: May 18,1992

5. Site Location: Houston, Harris County, Texas
   (City/County,State)

6. Congressional District: 18

7. Site Coordinates: Single

   Latitude: 29°40'48.0"   Longitude: 95°35'36.0"

Site Description

1. Setting: Urban

2. Current Owner: Private - Industrial

3. Current Site Status: Active

4. Years of Operation: Active Site , from and to dates: 1958-present

5. How Initially Identified: Citizen Complaint

6. Entity Responsible for Waste Generation:

   - Landfill
         - Municipal

7. Site Activities/Waste Deposition:

   - Municipal Landfill
   - Drum/Container Storage
   - Discharge to Sewer/Surface Water

Waste Description

8. Wastes Deposited or Detected Onsite:

   - Organic Chemicals
   - Acids/Bases
   - Metals
   - POTW Sludge Waste
   - Municipal Waste
   - Lead

Response Actions

9. Response/Removal Actions:

RCRA Information

10. For All Active Facilities, RCRA Site Status:

   - Not Applicable

Demographic Information

11. Workers Present Onsite: Yes

12. Distance to Nearest Non-Worker Individual: > 10 Feet - 1/4 Mile

13. Residential Population Within 1 Mile: 3044.0

14. Residential Population Within 4 Miles: 10867.0

Water Use Information

15. Local Drinking Water Supply Source:

   - Ground Water (within 4 mile distance limit)

16. Total Population Served by Local Drinking Water Supply Source: 608760.0

17. Drinking Water Supply System Type for Local Drinking
    Water Supply Sources:

    - Municipal (Services over 25 People)

18. Surface Water Adjacent to/Draining Site:

    - Other - Three intermittent ditches

REFERENCE 1

Latest
Version

FINAL RULE
HAZARD RANKING SYSTEM

NOVEMBER   1990

REFERENCE 2

Appendix B-1

Tables for Non-radioactive Hazardous Substances

REFERENCE 3

(b) (9)

SITE LOCATION MAP

DOTY SAND PIT

HOUSTON, TEXAS

TXD000327726

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

TEXAS

QUADRANGLE LOCATION
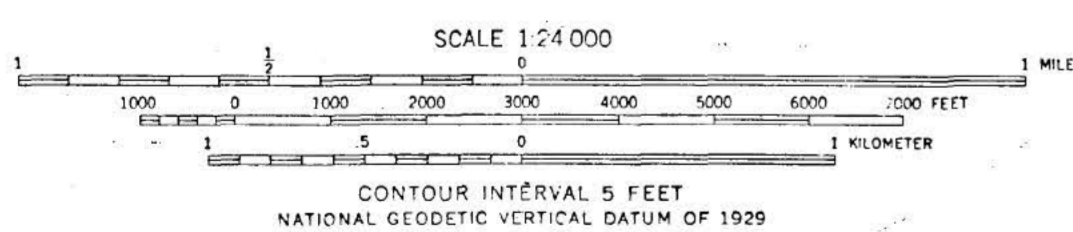
QUADRANGLES

ALIEF, TEX.
N2937.5-W9530/7.5
1982

CLODINE, TEX.
N2937.5-W9537.5/7.5
1982

MISSOURI CITY, TEX
N2930-W9530/7.5
1970
PHOTOREVISED 1980
DMA 6843 II SE-SERIES V882

REFERENCE 4

TECHNICAL PAPER NO. 40

RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD

Cooperative Studies Section, Hydrologic Services Division

for

Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

WASHINGTON, D.C.

May 1961

GULF OF MEXICO

REFERENCE 5

SOIL SURVEY OF
Harris County, Texas

Contents

Beaumont soils have a surface layer of very firm, very strongly acid, dark gray to gray clay about 21 inches thick. The surface layer grades gradually to a layer, about 38 inches thick, of very firm, strongly acid, gray clay that has intersecting slickensides. The next layer extends to a depth of 73 inches and is very firm, slightly acid, grayish brown clay that has mottles of light olive brown and strong brown.

Urban land consists of soils that have been altered or obscured by buildings or other urban structures making classification of the soils impractical. Typical structures are single- and multiple-unit dwellings, garages, sidewalks, patios, driveways, streets, schools, churches, shopping centers less than 40 acres in size, office buildings, paved parking lots, and industrial sites. Areas of the Beaumont soil and of other soils that have been altered by cutting, grading, and filling, make up some Urban land. In some areas the soil has not been altered but it is covered by 6 to 24 inches of clayey fill material.

Included in mapping are areas of Lake Charles, Bernard, Midland, and Vamont soils. These soils have been altered in some places.

This mapping unit has severe limitations for urban development. The main limitation is the high shrink-swell potential. Shrinking and swelling have caused driveways, sidewalks, patios, and ceilings to crack, rock retaining walls to buckle, and fences to shift. Corrosivity is high and many uncoated steel pipes are rusted through within 2 to 4 years. Landscaping and gardening are difficult on these soils. Hardwood trees have been planted or have encroached in most areas; pine have encroached in a few areas. Uncovered areas are muddy and sticky when wet, and roads need to be paved or shelled. These soils are not suitable for use as septic tank filter fields.

Bd—Bernard clay loam. This is a nearly level soil in broad, irregularly shaped areas that average 500 acres in size but range from 20 to 3,000 acres. The slope ranges from 0 to 1 percent but averages less than 0.5 percent.

The surface layer is friable, neutral, very dark gray clay loam about 6 inches thick. The layer below that is 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. The next layer is firm, moderately alkaline, gray clay that has distinct yellowish brown mottles and a few calcium carbonate concretions.

Included with this soil in mapping are a few areas of other soils, mainly Lake Charles and Addicks soils, and also Beaumont, Clodine, and Midland soils. These soils make up less than 15 percent of any mapped area.

This soil is used mainly for row crops, improved pasture, and native pasture. A few acres are used for rice. Principal row crops are cotton, corn, and grain sorghum. Improved pastures of bermudagrass and dallisgrass are common. The native vegetation is tall prairie grasses, including andropogons and paspalums.

This soil is somewhat poorly drained. Surface runoff is very slow. Internal drainage and permeability are very slow. The available water capacity is high.

This is a productive soil because its moisture holding capacity is favorable and its capacity to hold plant nutrients is favorable. In cultivated areas, fertilizer and crop residue management are needed to help maintain soil tilth and high production. Capability unit IIw-1; rice group 1; pasture and hayland group 7C; Blackland range site; woodland suitability group 2w9; Blackland woodland grazing group.

Be—Bernard-Edna complex. This complex is in broad areas on the coastal prairie. The areas average 250 acres, but some are several hundred acres in size. The surface is plane, concave, and convex and is characterized by many distinctive knolls and pimple mounds. The slope ranges from 0 to 2 percent but averages 0.8 percent.

Bernard clay loam and Edna fine sandy loam are the major soils. The Bernard soil makes up about 55 percent of the complex. It is generally in slightly concave depressions and on the flats between the knolls and pimple mounds of the Edna soil. The slope is from 0 to 1 percent. The Edna soil makes up about 30 percent of the complex. It is mainly on convex knolls, ridges, and circular pimple mounds. The slope is 1 to 2 percent. The rest of the complex is made up of closely associated soils, such as Addicks, Lake Charles, and Clodine soils. The soils in this complex are so intricately mixed that it was not feasible to separate them at the mapping scale for this survey. All the soils are generally used and managed alike.

The surface layer of the Bernard soil is friable, neutral, very dark gray clay loam about 6 inches thick. The layer below that is 48 inches thick and consists of firm, neutral, very dark gray clay in the upper part and very firm, moderately alkaline, dark gray clay in the lower part. The next layer is firm, moderately alkaline, gray clay that has distinct yellowish brown mottles and a few calcium carbonate concretions.

The Edna soil is similar to that described as representative of the Edna series, but its surface layer is slightly thicker. The surface layer is friable, neutral, dark grayish brown fine sandy loam about 10 inches thick. It is underlain abruptly by a layer of very firm, moderately alkaline clay, about 34 inches thick, that is gray in the upper part and olive gray in the lower part. The layer below that is firm, moderately alkaline, gray sandy clay loam that has mottles of yellowish brown.

Most areas of this complex are in native pasture of beaked panicum, paspalum, sporobolus, and andropogon. Cultivated areas require land leveling to smooth the moundy areas.

The soils in this complex are somewhat poorly drained to poorly drained. They are generally saturated in winter and in early spring. Internal drainage and permeability are very slow. The available water capacity is medium to high.

The moundy surface and poor drainage are the major concerns of management. Drainage, fertilization, and land leveling are needed for cultivated crops. Capability unit IIw-1; rice group 1; pasture and hayland group 7C; Blackland range site, Bernard soil, and Claypan Prairie

films; vertical streaks of uncoated fine sand and silt 2 millimeters thick between prism faces; very strongly acid; gradual wavy boundary.

B22tg—33 to 43 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine and medium distinct yellowish brown (10YR 5/8) mottles and common fine prominent red mottles; weak coarse prismatic structure parting to moderate fine angular blocky; extremely hard, firm, sticky and plastic; patchy clay films; uncoated fine sand and silt coatings on faces of prisms; strongly acid; diffuse wavy boundary.

B23tg—43 to 60 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine prominent red mottles and few fine distinct yellowish brown mottles; weak fine angular blocky structure; extremely hard, firm, sticky and plastic; patchy clay films; medium acid.

The Ap horizon is 3 to 8 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. It is strongly acid through slightly acid. The A&B horizon is brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. Mottles are strong brown or yellowish brown. The A&B horizon is sandy loam, fine sandy loam, or very fine sandy loam. It is strongly acid through slightly acid. The B&A horizon is yellowish brown, light yellowish brown, or brownish yellow. Mottles are red, yellowish red, strong brown, light brownish gray, or light gray. The B&A horizon is clay loam, silty clay loam, or sandy clay loam. It is very strongly acid through medium acid. The B2t horizon is clay loam, silty clay loam, sandy clay, or clay. It is very strongly acid through medium acid. The matrix in the upper part of the B2t horizon is strong brown, yellowish brown, or brownish yellow. It contains mottles of red, gray, light brownish gray, or light gray. The matrix in the lower part of the B2t horizon is gray, light brownish gray, or light gray. Mottles are red, strong brown, yellowish brown, or brownish yellow. In a few places horizons below a depth of 50 inches contain a few pitted calcium carbonate concretions.

Beaumont Series

The Beaumont series consists of deep, acid, nearly level, clayey soils on upland prairies. These soils formed in thick beds of alkaline marine clay.

Undisturbed areas of these soils have gilgai microrelief, in which the microknolls are 6 to 12 inches higher than the microdepressions. When these soils are dry they have deep, wide cracks that extend to the surface. During rainstorms, water enters the cracks rapidly. When the soils are wet and the cracks are closed, water moves very slowly into the soil. Beaumont soils are poorly drained. Surface runoff and internal drainage are very slow. Permeability is very slow, and the available water capacity is high.

Some of these soils are used for rice and pasture plants. Pine and hardwood trees have encroached in a few areas. Some areas are covered by buildings and other urban structures.

Representative profile of Beaumont clay, in pasture, in the center of a microdepression, from the intersection of Red Bluff Road and Bay Area Boulevard (about 4 miles northeast of Clear Lake City), 1.0 mile northwest along Red Bluff Road, 1.35 miles north on the service road along the east side of Big Island Slough to the intersection with a pipeline, 0.3 mile east along the pipeline, and 100 feet south:

A11—0 to 9 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine and medium distinct mottles of dark reddish brown (5YR 3/3); reddish brown (5YR 4/4) stains along root channels and on ped faces; moderate medium angular blocky structure; very

hard, very firm, very sticky and plastic; many fine roots; ⸱ pressure faces; common black masses of partly decomposed matter; few shotlike iron-manganese concretions; very ⸱ acid; clear smooth boundary.

A12—9 to 21 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; ⸱ fine and medium distinct dark brown (7.5YR 4/4) stains alc channels and on ped faces; moderate medium angular block ture; extremely hard, very firm, very sticky and plastic; ⸱ fine roots; many shiny pressure faces; few worm casts; fe organic stains; few fine iron-mangenese concretions; very ⸱ acid; gradual wavy boundary.

AC1g—21 to 43 inches; gray (10YR 6/1) clay, light gray (10YR ⸱ many fine and medium distinct mottles of dark brown (7.5⸱ many ped faces coated with gray (10YR 5/1) clay; distinc lelepipeds parting to moderate fine and medium angular structure; extremely hard, very firm, very sticky and plas fine roots; common coarse intersecting slickensides; man pressure faces; dark brown stains along root channels; f iron-manganese concretions; common cracks 3 to 4 centimet⸱ filled with gray (10YR 5/1) clayey material; very strongly ⸱ fuse wavy boundary.

AC2g—43 to 59 inches; gray (10YR 6/1) clay, light gray (10YR common fine distinct mottles of dark yellowish brown; parallelepipeds parting to moderate fine and medium angula structure; extremely hard, very firm, very sticky and plas⸱ mon coarse intersecting slickensides; common shiny pressu⸱ few fine iron-manganese concretions; strongly acid; gradu boundary.

Cg—59 to 73 inches; grayish brown (2.5Y 5/2) clay, light brown (2.5Y 6/2) dry; common fine faint mottles of light olive br⸱ few fine distinct mottles of strong brown; weak coarse blocky structure; extremely hard, very firm, very sticky anc few slickensides; neutral.

The A horizon is 10 to 25 inches thick. It is very dark gray, da or gray. Mottles are dark reddish brown, reddish brown, darⱶ yellowish brown, or light olive brown. The A horizon is very ⸱ acid through slightly acid. The ACg horizon is dark gray, gray, gray. Mottles are reddish brown, dark brown, dark yellowisⱶ strong brown, yellowish brown, or brownish yellow. The ACg h clay or silty clay. It is very strongly acid through medium acid. horizon is gray, light gray, grayish brown, or light brownish gr tles are yellow or brown. The Cg horizon is clay or silty cl⸱ strongly acid through mildly alkaline. In a few places calcium c⸱ concretions are below a depth of 65 inches.

Bernard Series

The Bernard series consists of deep, neutral, level to gently sloping, loamy soils on upland p⸱ These soils have a loamy surface layer about 6 thick underlain by clayey lower layers (fig. 7). formed in clayey unconsolidated sediments.

These soils are somewhat poorly drained. Surf⸱ noff is very slow. Internal drainage is slow to ver⸱ Permeability is very slow, and the available water ty is high.

These soils are used mainly for row crops, im pasture, and native pasture. A large area is cove buildings and other urban structures.

Representative profile of Bernard clay loam, in from intersection of Cook Road and Alief Road ir 1.11 miles west along Alief Road, 0.96 mile so⸱ Synott Road, and 80 feet west:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay loam, d⸱ (10YR 4/1) dry; moderate medium granular structure; ve

friable; many fine roots; common fine pores; common worm casts; few shotlike iron-manganese concretions; neutral; clear smooth boundary.

B1g—6 to 18 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, firm; common fine roots; common fine pores; patchy clay films; few shotlike iron-manganese concretions; neutral; gradual wavy boundary.

B21tg—18 to 34 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium and coarse blocky structure; few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few very fine pores; clay films on ped surfaces; few shotlike iron-manganese concretions; mildly alkaline; noncalcareous in matrix; diffuse wavy boundary.

B22tg—34 to 54 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown mottles mainly surrounding iron-manganese and calcium carbonate concretions; weak coarse blocky structure; a few slickensides that do not intersect; extremely hard, very firm, sticky and plastic; few patchy clay films; few shotlike iron-manganese concretions; few irregularly shaped calcium carbonate concretions that have pitted surfaces and that are mainly less than 1 centimeter in size; moderately alkaline; noncalcareous in matrix; gradual wavy boundary.

B3g—54 to 65 inches; gray (5Y 5/1) clay, light gray (5Y 6/1) dry; common vertical streaks of dark gray (10YR 4/1) and few fine distinct yellowish brown and strong brown mottles; massive; very hard, firm, sticky and plastic; few shotlike iron-manganese concretions; about 5 to 7 percent calcium carbonate concretions less than 3 centimeters in size that are irregularly shaped and have pitted surfaces; moderately alkaline, noncalcareous in matrix.

The Ap horizon is 3 to 8 inches thick. It is black, very dark gray or very dark grayish brown and is slightly acid through moderately alkaline. The B1g horizon is the same color as the A horizon. It is clay, clay loam, or silty clay loam that is more than 35 percent clay. It is neutral through moderately alkaline. The B2tg horizon is black, very dark gray, dark gray, gray, very dark grayish brown, dark olive gray, dark grayish brown, olive gray, or grayish brown. It has mottles of yellow or brown. It is clay or silty clay, and is mildly alkaline through moderately alkaline. The B3g horizon is gray, light gray, grayish brown, light brownish gray, olive gray, or light olive gray. It is mottled with yellow, brown, or olive in most places. It is clay, clay loam, or silty clay loam.

Bissonnet Series

The Bissonnet series consists of deep, nearly level, loamy soils on forested uplands. The loamy upper layers of these soils tongue into the more clayey lower layers (fig. 8). These soils formed in thick beds of unconsolidated clay and clay loam sediments.

These soils are somewhat poorly drained. During some wet seasons, they have a perched water table and the lower layers are saturated for 1 to 4 months. Surface runoff and permeability are slow and the available water capacity is high.

Most of these soils are in pine and hardwood trees. Woodland grazing is the main use. A few areas have been cleared and are used for improved pasture and cultivated crops.

Representative profile of Bissonnet very fine sandy loam, in timber, from the intersection of Farm Roads 1960 and 2100 in Huffman, 3.4 miles south along Farm Road 2100, 1.72 miles west on Indian Shores Road, and 400 feet south:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; few fine roots; common fine pores; common worm casts; very strongly acid; clear wavy boundary.

A21—6 to 24 inches; brown (10YR 5/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles and strong brown stains; many sand and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear wavy boundary.

A22—24 to 28 inches; pale brown (10YR 6/3) very fine sandy loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown mottles; many sand and silt grains are uncoated; weak fine granular structure; slightly hard, friable; few fine roots; few fine pores; few worm casts; very strongly acid; clear smooth boundary.

B&A—28 to 32 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; common fine distinct mottles of yellowish brown, strong brown, and red; 15 to 30 percent light gray (10YR 7/2) very fine sandy loam surrounding isolated bodies of more clayey Bt material; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores, some lined with clay; reddish stains in old root channels; few clay films on surfaces of some peds; few black concretions; many uncoated sand grains; very strongly acid; clear irregular boundary.

B21tg—32 to 42 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium prominent red (2.5YR 4/6) mottles and common fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; few fine pores; discontinuous clay films on faces of peds; some ped surfaces covered with uncoated fine sand and silt grains; very strongly acid; gradual boundary.

B22tg—42 to 70 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium distinct yellowish brown (10YR 5/6) mottles and few fine prominent red mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; discontinuous clay films on faces of peds; some surfaces of peds covered with uncoated fine sand and silt grains; some organic staining on faces of prisms; mildly alkaline in lower part of horizon; noncalcareous.

The A horizon is 20 to 40 inches thick. It is very strongly acid through medium acid. The A1 horizon is dark gray, dark grayish brown, gray, grayish brown, or brown. The A2 horizon is grayish brown, brown, light brownish gray, pale brown, or light yellowish brown. Some profiles have mottles of strong brown, brownish yellow, or yellowish brown in the A2 horizon. The B&A horizon is light brownish gray, pale brown, brown, yellowish brown, or light yellowish brown. It is sandy clay loam, loam, or silty loam. The B&A horizon has mottles of strong brown, yellowish brown, or red. It is very strongly acid through medium acid. The B2t horizon is gray, light brownish gray, or light gray. Mottles are brownish yellow, yellowish brown, strong brown, or red. The B2t horizon is clay loam, sandy clay loam, or silty clay loam. It is very strongly acid through slightly acid in the upper part. It ranges to mildly alkaline in the lower part in some places.

Boy series

The Boy series consists of deep, acid, nearly level to gently sloping, sandy soils in forest. These soils formed in unconsolidated beds of sand, loamy sand, and loam.

These soils are somewhat poorly drained. During wet periods they are saturated for 2 to 4 months in the layer containing plinthite and the soil just above it. Surface runoff is very slow, and in places it is not a hazard at all. Internal drainage and permeability are rapid above the layer containing plinthite, and permeability is moderately slow in the layer containing plinthite. The available water capacity is low.

3 085 000 FEET

SOUTHERN PACIFIC

Alief

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Bd

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LcA

SAND PIT

PLANT

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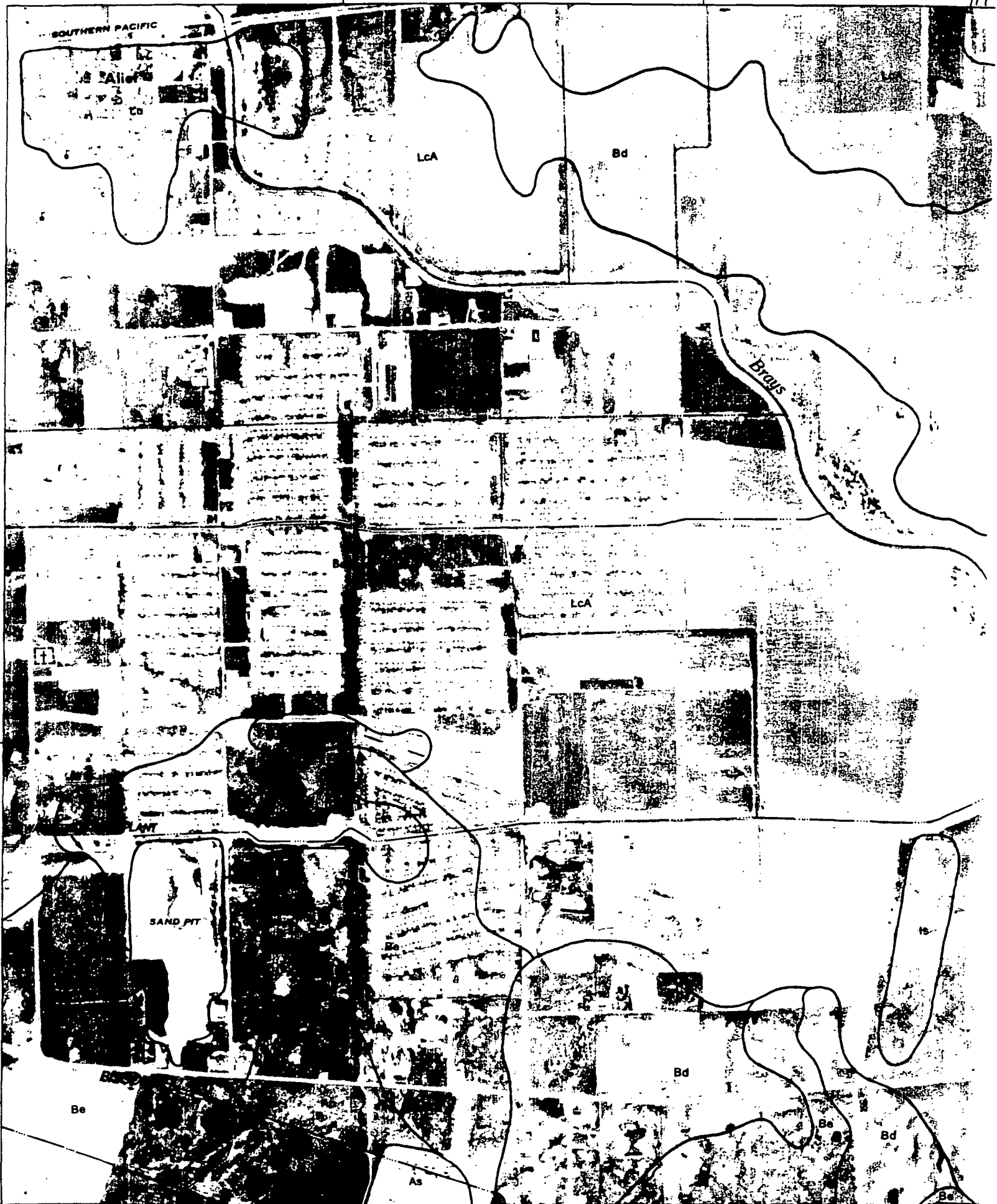
REFERENCE 6

(b) (9)

Refer to the Flood Insurance Rate Map Effective date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE

1000   0   1000 FEET
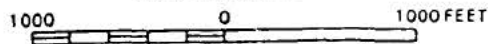
NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

HARRIS COUNTY, TEXAS AND INCORPORATED AREAS

PANEL 315 OF 390

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HOUSTON, CITY OF	480296	0315	G
UNINCORPORATED AREAS	480287	0315	G

MAP NUMBER

48201C0315 G

EFFECTIVE D...

(b) (9)

REFERENCE 7

REF 7

TEXAS * WATER * COMMISSION
8900 Shoal Creek Blvd., Bldg. 200 , Austin, Tx. 78758
Telefax #: (512) 371-8202

FAX COVER LETTER

DATE: _7-9-91_

TO:

Company: _ICS TECHNOLOGY_

Name: _KIM BIRDSALL_

City: _DALLAS_   State: _TEXAS_

Fax #: _214 - 247 1826_

FROM:

Company: TEXAS WATER COMMISSION

Name: _ARLETTE CAPEHART_

Phone No.: _512 - 371 - 6390_

COMMENTS:

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Total Number of Pages Being Sent Including This Cover Sheet [5]

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STATUS

NUMBER

TYPE

BASIN

COUNTY

RIVER ORDER NO.

PERMIT NO.

OWNER(S)

STREAM

TYPE OF USE

AMOUNT OF WATER

NUMBER OF ACRES

PRIORITY DATE

RESERVOIR CAPACITY

DATE ISSUED

TERM STATUS

TYPE OF WATER USES

1. MUNICIPAL/DOMESTIC
2. INDUSTRIAL
3. IRRIGATION
4. MINING
5. HYDROELECTRIC

6. NAVIGATION
7. RECREATION
8. FLOOD CONTROL
9. RECHARGE

TYPE OF WATER RIGHTS

1 - APPLICATION/PERMIT
2 - CLAIM
3 - CERTIFIED FILING
5 - DISMISSED/REJECTED
6 - CERTIFICATION OF ADJUDICATION
9 - CONTRACTUAL PERMIT/AGREEMENT

STATUS OF WATER RIGHTS

A - ADJUDICATED
P - PARTIALLY CANCELLED
R - DISMISSED/REJECTED
T - TOTALLY CANCELLED

TERM STATUS

A - SPECIFIC DATE
B - NO SPECIFIC DATE
C - PERMIT TO BE REDUCED IF AWARDED A RIGHT
      UNDER CLAIM
D - NOT AUTHORIZED TO USE UNTIL AMENDED

BASIN CODES

1. CANADIAN
2. RED
3. SULPHUR
4. CYPRESS
5. SABINE
6. NECHES
7. NECHES-TRINITY
8. TRINITY
9. TRINITY-SAN JACINTO
10. SAN JACINTO
11. SAN JACINTO-BRAZOS
12. BRAZOS

13. BRAZOS-COLORADO
14. COLORADO
15. COLORADO-LAVACA
16. LAVACA
17. LAVACA-GUADALUPE
18. GUADALUPE
19. SAN ANTONIO
20. SAN ANTONIO-NUECES
21. NUECES
22. NUECES-RIO GRANDE
23. RIO GRANDE

COUNTY CODE LIST

1-Anderson	52-Crane	103-Hartley	154-McCulloch	205-San Patricio
2-Andrews	53-Crockett	104-Haskell	155-McLennan	206-San Saba
3-Angelina	54-Crosby	105-Hays	156-McMullen	207-Schleicher
4-Aransas	55-Culberson	106-Hemphill	157-Madison	208-Scurry
5-Archer	56-Dallam	107-Henderson	158-Marion	209-Shackelford
6-Armstrong	57-Dallas	108-Hidalgo	159-Martin	210-Shelby
7-Atascosa	58-Dawson	109-Hill	160-Mason	211-Sherman
8-Austin	59-Deaf Smith	110-Hockley	161-Matagorda	212-Smith
9-Bailey	60-Delta	111-Hood	162-Maverick	213-Somervell
10-Bandera	61-Denton	112-Hopkins	163-Medina	214-Starr
11-Bastrop	62-DeWitt	113-Houston	164-Menard	215-Stephens
12-Baylor	63-Dickens	114-Howard	165-Midland	216-Sterling
13-Bee	64-Dimmit	115-Hudspeth	166-Milam	217-Stonewall
14-Bell	65-Donley	116-Hunt	167-Mills	218-Sutton
15-Bexar	66-Duval	117-Hutchinson	168-Mitchell	219-Swisher
16-Blanco	67-Eastland	118-Irion	169-Montague	220-Tarrant
17-Borden	68-Ector	119-Jack	170-Montgomery	221-Taylor
18-Bosque	69-Edwards	120-Jackson	171-Moore	222-Terrell
19-Bowie	70-Ellis	121-Jasper	172-Morris	223-Terry
20-Brazoria	71-El Paso	122-Jeff Davis	173-Motley	224-Throckmorton
21-Brazos	72-Erath	123-Jefferson	174-Nacogdoches	225-Titus
22-Brewster	73-Falls	124-Jim Hogg	175-Navarro	226-Tom Green
23-Briscoe	74-Fannin	125-Jim Wells	176-Newton	227-Travis
24-Brooks	75-Fayette	126-Johnson	177-Nolan	228-Trinity
25-Brown	76-Fisher	127-Jones	178-Nueces	229-Tyler
26-Burleson	77-Floyd	128-Karnes	179-Ochiltree	230-Upshur
27-Burnet	78-Foard	129-Kaufman	180-Oldham	231-Upton
28-Caldwell	79-Fort Bend	130-Kendall	181-Orange	232-Uvalde
29-Calhoun	80-Franklin	131-Kenedy	182-Palo Pinto	233-Val Verde
30-Callahan	81-Freestone	132-Kent	183-Panola	234-Van Zandt
31-Cameron	82-Frio	133-Kerr	184-Parker	235-Victoria
32-Camp	83-Gaines	134-Kimble	185-Parmer	236-Walker
33-Carson	84-Galveston	135-King	186-Pecos	237-Waller
34-Cass	85-Garza	136-Kinney	187-Polk	238-Ward
35-Castro	86-Gillespie	137-Kleberg	188-Potter	239-Washington
36-Chambers	87-Glasscock	138-Knox	189-Presidio	240-Webb
37-Cherokee	88-Goliad	139-Lamar	190-Rains	241-Wharton
38-Childress	89-Gonzales	140-Lamb	191-Randall	242-Wheeler
39-Clay	90-Gray	141-Lampasas	192-Reagan	243-Wichita
40-Cochran	91-Grayson	142-La Salle	193-Real	244-Wilbarger
41-Coke	92-Gregg	143-Lavaca	194-Red River	245-Willacy
42-Coleman	93-Grimes	144-Lee	195-Reeves	246-Williamson
43-Collin	94-Guadalupe	145-Leon	196-Refugio	247-Wilson
44-Collingsworth	95-Hale	146-Liberty	197-Roberts	248-Winkler
45-Colorado	96-Hall	147-Limestone	198-Robertson	249-Wise
46-Comal	97-Hamilton	148-Lipscomb	199-Rockwall	250-Wood
47-Comanche	98-Hansford	149-Live Oak	200-Runnels	251-Yoakum
48-Concho	99-Hardeman	150-Llano	201-Rusk	252-Young
49-Cooke	100-Hardin	151-Loving	202-Sabine	253-Zapata
50-Coryell	101-Harris	152-Lubbock	203-San Augustine	254-Zavala
51-Cottle	102-Harrison	153-Lynn	204-San Jacinto	

EDITPR NO.	TYPE	BASIN	COUNTY	RIVER ORDER NO.	PERMIT NO.	OWNER	STREAM	TYPE OF USE	AMOUNT OF WATER	NO. OF ACRES	PRIORITY DATE	RESERVOIR CAPACITY	DATE ISSUED
003951	6	10	170	8620000000		MAGNOLIA BEND PROP. OWNERS	OLD BOGGY	7			19750728		19860314
003950	6	10	170	8640000000		CONROE CREOSOTING CO.	LITTLE CANEY	7			19790604	44	19860314
003948	6	10	170	8660000000		SAN JACINTO GIRL SCOUTS	STEWARTS &TRIB	7			19750120		19860314
004248	1	10	170	8665000000	003937	PANORAMA COUNTRY CLUB INC	STEWARTS CR	3	116	87	19820920	93	19830127
003949	6	10	170	8670000000		RIVERBROOK COMMUNITY IMP ASSN	UNNAMED	7			19750120	117	19860314
003946	6	10	170	8800000000		LAKE FOREST LODGE, INC.	FISH	7			19551108	182	19860314
003947	6	10	170	8800200000		MITCHELL DEVELOPMENT CORP	FISH	7			19781010	287	19860314
005311	1	10	101	8870000000	005311	BRAE-BURN COUNTRY CLUB	BRAYS BAYOU	3	200	132	19900907		18810103
003945	6	10	170	8880000000		DEER LAKE LODGE PROP. OWNERS	UNNAMED	7			19750408	70	19860314
003944	6	10	170	8880400000		LAKE BONANZA PROP. OWNERS	UNNAMED	7			19751201	116	19860314
003943	6	10	170	8920000000		177 LAKE ESTATES ASSN., INC.	UNNAMED	7			19750707		19860314
003942	6	10	170	8976000000		TRI-LAKE ESTATES PROP. OWNERS	UNNAMED	7			19741202		19860314
003941	6	10	093	8980000000		SELECTED LANDS CORP	CANEY	3	300	127	19740701	160	19860314
004038 A	1	10	170	8985000000	003752A	CONROE COUNTRY CLUB	UNNAMED	7			19800331	65	19800904
003940	6	10	170	9099900000		LAKE FOREST FALLS, INC.	BASE	7			19750203	605	19860314

EDITPR NO.	TYPE	BASIN	COUNTY	RIVER ORDER NO.	PERMIT NO.	OWNER	STREAM	TYPE OF USE	AMOUNT OF WATER	NO. OF ACRES	PRIORITY DATE	RESERVOIR CAPACITY	DATE ISSUED
004963	6	10	170	9100000000		SAN JACINTO RIVER AUTH ET AL	W F SAN JACINT	2	28500		19590112		19870225
004963	6	10	170	9100000000		SAN JACINTO RIVER AUTH ET AL	W F SAN JACINT	4	5500		19590112		19870225
000070	9	10	170	9100000000	0049636	GULF STATES UTILITIES CO	W SAN JACINTO	2	6400		19730109		19690709

EDITPR NO.	TYPE	BASIN	COUNTY	RIVER ORDER NO.	PERMIT NO.	OWNER	STREAM	TYPE OF USE	AMOUNT OF WATER	NO. OF ACRES	PRIORITY DATE	RESERVOIR CAPACITY	DATE ISSUED
003939	6	10	170	9101000000		LAKE CONROE FOREST OWNERS ASSN	RUSH & TRIB	7			19750203	242	19860314
004966	6	10	170	9102000000		GULF STATES UTILITIES CO	LEWIS CREEK	2			19670808	17000	19870225
004966	6	10	170	9102000000		GULF STATES UTILITIES CO	LEWIS CREEK	2			19670808		19870225
003938	6	10	170	9104490000		WEISINGER ESTATE	UNNAMED	7			19750127	68	19860314
003937	6	10	170	9104500000		PINE LAKE CLUB, INC	UNNAMED	7			19750303	93	19860314
003936	6	10	170	9105000000		CAPE CONROE, LTD.	UNNAMED	7			19740603	67	19860314
004523 A	1	10	170	9109700000	004227A	J H WILKENFELD TRUSTEE ET AL	UNNAMED	7			19841204		19850626

STATUS	EDITOR NO.	TYPE	BASIN	COUNTY	RIVER ORDER NO.	PERMIT NO.	OWNER	STREAM	TYPE OF USE	AMOUNT OF WATER	NO. OF ACRES	PRIORITY DATE	RESERVOIR CAPACITY	DATE ISSUED
A	003000	1	10	101	1200000000	002731	GENERAL PORTLAND INC	BUFFALO BAYOU	2	1615		19720327		19720517
T	002388	1	10	101	1275000000	002162	HOUSTON L&P CO-GABLE	BUFFALO	2	103527	625	19650407		19650615
	005209	1	10	101	1300000000	005209	INWOOD FOREST GOLF CLUB LTD	WHITE OAK BAYO	3	230	98	19881215	16	19890406
T	000390	3	10	101	1400000000		GLENWOOD CEMETARY ASSN	BUFFALO	3	0000000030	0000020	19140623		19140630
A	003072	1	10	101	1400700000	002790	THE MUSEUM OF FINE ARTS	BUFFALO BAYOU	3	19	8	19720911		19721101
	003986	6	10	101	1400700000		MUSEUM OF FINE ARTS	BUFFALO BAYOU	3	19	8	19720911		19860314
A	003850	1	10	101	1400800000	003556	RIVER OAKS COUNTRY CLUB	BUFFALO BAYOU	3	460	129	19780130	75	19780412
	003985	6	10	101	1400800000		RIVER OAKS COUNTRY CLUB	BUFFALO	3	460	129	19780130	75	19860314
	005336	1	10	101	1800000000	005336	HOUSTON COUNTRY CLUB	BUFFALO BAYOU	3	175	118	19901205	20	19910319
A	003275	2	10	101	1980000000		JOSEPH W TAYLOR ET AL	BUFFALO BAYOU	3	6	6	19690829		19700220
T	000923	1	10	101	2000000000	000879	J A RUSH	BUFFALO	3	0000000080	0000040	19250516	0004	19260818
	005257	1	10	101	2500000000	005257	LAKESIDE COUNTRY CLUB	BUFFALO BAYOU	3	175	70	19890913	75	19900529
T	000162	3	10	101	2600000000		A STOCKDICK ESTATE	SO MAYDE	3	0000000000	0000000	19140507		19140613
A	003350	2	10	101	2620000000		LENOIR M JOSEY INC	LANGHAM	3	50	200	19690830		19700227
	003984	6	10	101	2620000000		LENOIR M. JOSEY, INC.	LANGHAM	3	26	56	19630630		19860314
	005332	1	10	101	2623000000	005332	PINE FOREST COUNTRY CLUB	BEAR CRK	3	378	150	19901128	35	19910319
	004066 A	1	10	101	2625000000	003779A	MARIAN W FLEMING	BEAR CR	3	45	25	19800811	9	19801209
A	002031	2	10	101	2630000000		HAROLD FREEMAN	BEAR CR	3	800	0000400	19690826	0150	19691114
	003983	6	10	101	2630000000		HAROLD & JESSE FREEMAN	BEAR	3	800	408	19161231	150	19860314
A	001251	2	10	079	2800000000		JAMIE A ROBINSON ET AL	BUFFALO B	3	0000000200	0000100	19690825		19690930
	003982	6	10	079	2800000000		CINCO RANCH VENTURE	BUFFALO	3	45	29	19520630		19860314
A	001252	2	10	101	2810000000		JAMIE A ROBINSON ET AL	BUFFALO B	3	0000000100	0000100	19690825		19690930
A	001253	2	10	101	2820000000		JAMIE A ROBINSON ET AL	BUFFALO BAYOU	3	0000000100	0000050	19690825		19690930
T	000013	3	10	101	3000000000		SAN JACINTO RICE CO	S JACINTO	3	0000021000	0014000	19131216		19131229
T	001519	1	10	101	3400000000	001414	TEXAS BUTADIENE-CHEM	S JACINTO	3	0000000640	0000320	19470521		19470719
R	000514 R	4	10	101	3600000000	0000000	SIEBER AND FLEMING	S JACINTO	3			19200915		
	005334	1	10	101	3640000000	005334	COOPER'S MARINE SER. INC	OLD RIVER CH	2			19901127		19910319

REFERENCE 8
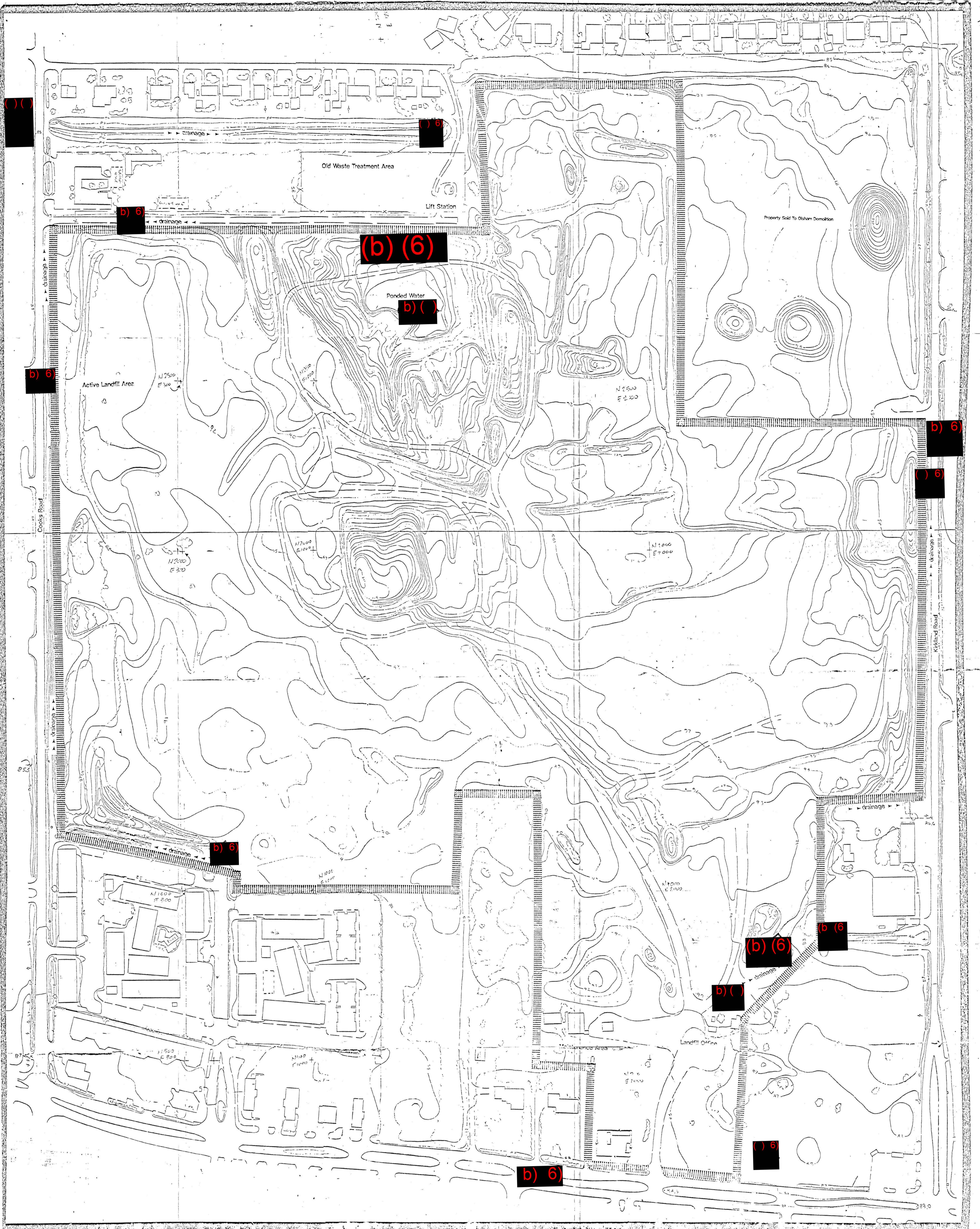
SAMPLE LOCATION MAP
DOTY SAND PIT
HOUSTON, TEXAS

Appendix C

CERCLIS NO. TXD000327726

REFERENCE 9

TO: File

FROM: Kevin Jaynes, ICF Technology, Inc.

DATE: May 16, 1992

REF: ARCS Contract No. 68-W9-0025

SUBJ: Summary of On-Site Reconnaissance and Sampling Inspection for Doty Sand Pit

The following is a summary of the on-site reconnaissance inspection and the sampling inspection logbooks for Doty Sand Pit (TXD000327726).

The EPA Region VI Field Investigation Team (FIT) conducted an on-site reconnaissance inspection of the Doty Sand Pit (TXD000327726), Houston, Texas. FIT members present during the inspection were Don Hudnall, Team Leader; Nancy Roberts, Site Safety Officer; and Curtis Steger, Inspector. The FIT met with Jack Reedy, site operator and Rocky Stevens, a Professional Engineer employed by Harding Lawson and Associates who represented the site owner, Mr. Virgil Mott.

The Doty Sand Pit (DSP) consists of approximately 125 acres operating with 9 employees on-site, full time. The landfill initially began operation over 40 years ago as a 55 acre site. The older section of the landfill, as explained by Mr. Stevens, is considered to be the eastern portion of the site which is now covered.

Drainage of the site flows from the center of the site exiting in any direction to drainage ditches surrounding the site boundary.

The FIT noted an area located north of the front office that was being used to store 55 gallon drums. Approximately 40 drums were located in this area of approximately 1,000 square feet. The FIT also noted that the soils were oil-stained and a few drums were labelled "multi-purpose gear oil".

The FIT noted an area in the northeastern portion of the area which is the Olshan Landfill. This landfill area was about 4 feet lower in elevation than DSP and was covered with vegetation. Olshan landfill did not appear to be active, but there was an abandoned tank on the property and the property was fenced off along (b) (6)

The FIT noted an area of ponded water in the northern portion of DSP. The pond was filled with water and lime and was highly vegetated with cattails. A distinct hydrogen sulfide odor was noted. Mr. Stevens stated to the FIT that the pond water is pumped through PVC pipe to the western portion of the landfill for infiltration. The pond is pumped twice a day. Water was seen leaking from the north wall of the depression area of ponded water. Mr. Stevens stated that the

area was originally excavated for landfill, a city water line broke in 1987 and filled the depression with water. The water line break is supposedly repaired. Mr. Stevens continued stating that the City of Houston identified a break in one of the sewer lines in November 1990 and was completing repairs at present. The FIT noted that water was flowing from the north wall through breaks in the clay liner, under the dirt road and into the pond. The north wall is also eroding toward the lift station.

Photographs of areas of concern and possible sampling locations were recorded during the inspection.

The FIT implemented the SSI Workplan for DSP on January 22-23, 1991. The sampling team consisted of Don Hudnall, Team Leader; Nancy Roberts, Site Safety Officer; and samplers Mengistu Lemma, Carol Cox and Brad Cune. A total of 20 samples were collected which included on-site and off-site samples, duplicates, QA/QC and a trip blank. All field activities were conducted in accordance with EPA approved Field Standard Operating Procedures.

Mr. Stevens was present during the collection of all samples, taking photographs, making notes and marking all sample locations with flagged stakes. Mr. Stevens and DSP had initially requested split samples, but did not collect samples or split samples with the FIT during the sampling.

The FIT collected three surface water samples in the area of ponded water. The samples were collected in a glass beaker and immediately poured into glass sample jars for shipping. Three sediment samples were also collected at this location. A trip blank for the surface water matrix was collected from de-ionized water at the command post location.

Four soil samples were collected in the drum storage area. Samples were collected with stainless steel trowels and transferred to glass sample jars. Composite samples were homogenized in an aluminum pan prior to transfer to sample jars.

A composite soil sample was collected at the home of (b) (6) (b) (6)

Additional soil samples were collected from the ditch on the east side of the site next to (b) (6) (b) (6) the ditch south of the site, next to the apartment complex; from the ditch next to (b) (6) (b) (6) close to the active landfill; from the ditch adjacent to the northern wall; and from the drainage canal north of the site as it enters the underground culvert.

Background samples for each medium were collected during the sampling event. The background water sample was collected on the west side of Cook Road from the canal as it flowed east to the site. A background sediment was also collected at this location. A background soil sample was collected on-site from a grassy area south of the office near the entrance.

REFERENCE 10

RECORD OF COMMUNICATION

TYPE: Phone Call   **DATE:** 2/20/92   **TIME:** 9:15 AM

TO: Dorinda Sullivan
Texas Parks and Wildlife
Department
Austin, TX
(512) 389-4800

FROM: Alex Zocchi
ICF Technology
Dallas,TX
(214) 979-3900

SUBJECT: Threatened or Endangered Species Around Doty Sand Pit

SUMMARY OF COMMUNICATION:

Mrs. Sullivan said that there is a possibility of the Hymenoxys texana, a Federal and State listed endangered plant existing within a 4-mile radius of the Doty Sand Pit. She also said that there are no threatened or endangered species, sensitive environments or wetlands within 15 miles downstream of the Doty Sand Pit.

REFERENCE 11

RECORD OF COMMUNICATION

TYPE: Phone Call   **DATE:** 11/30/89   **TIME:** 2:20 PM

TO: Kay Hodges
Chamber of Commerce
Houston, TX
(713) 651-1313

FROM: Luis Vega
FIT Biologist
EPA Region VI
ICF Technology, Inc.
Dallas, TX 75201
(214) 744-1641

SUBJECT: Population Density of the Houston/Harris County, TX Area

SUMMARY OF COMMUNICATION:

In a phone call with Kay Hodges of the Houston Chamber of Commerce, the following information was given:

The population of Houston, Harris County, TX in the consolidated metropolitan statistical area is 3,580,000. This includes the surrounding counties and incorporated limits covering an area of 7,422.38 square miles.

The population of Harris County only is 2,740,900.

The population of Houston, Harris County, TX in the principle metropolitan statistical area is 3,182,900, and covers an area of 5,435.48 square miles. The number of households in Houston is 1196,700, which gives an average population per household of 2.66.

NOTE: The above information is based upon the 1980 Census information.

CONCLUSIONS, ACTION TAKEN OR REQUIRED:

Using the data for the principle metropolitan statistical area, the population density for the Houston, Harris County, TX area is calculated as 586 persons per square mile in the population dense areas designated as "Red Zones" on the topographic map.

$$3,182,900 \div 5,435.48 \text{ mile}^2 = 585.85 \text{ persons/mile}^2$$
$$= 586 \text{ persons/mile}^2$$

REFERENCE 12

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN HARRIS AND GALVESTON COUNTIES, TEXAS, 1980-84

By James F. Williams, III, L.S. Coplin, C.E. Ranzau, Jr., W.B. Lind, C.W. Bonnet, and Glenn L. Locke

1987

(b) (9)

Figure 1.--Location of wells in Harris County.

Table 1.--Records of Wells in Harris County

Water Levels and Drawdown	:	Reported water levels given in feet; measured water levels given in feet.
Use of Water	:	H, domestic; I, irrigation; N, industrial; P, public supply; R, recreational; T, institution; U, unused.
Water-Bearing Unit	:	CHCT, Chicot aquifer; EVGL, Evangeline aquifer; JSPR, Jasper aquifer.
Type of Data Available	:	C, caliper log; D, drillers' log (see table 2); E, electric log; I, induction log; J, gamma-ray; L, lateral log; M, microlateral log; N, neutron log; Q, chemical analysis (see table 4); S, sonic log; W, water-level measurements (see table 3).

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level Below land surface datum (feet)	Water level Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
(b) (9)															
LJ-60-57-908	Lindsey, C.N., Well No. 3	Layne-Texas Co.	1982	910	18,12	350	200 - 900	EVGL	234	147.00	03/06/1982	I	3,046	80.00	D,I
(b) (9)															
LJ-60-60-504	Glenloch Farms, Well No. 3	Raymond Water Wells	1979	363	6,4	37	296 - 363	CHCT	146	115.00	10/20/1979	I	--	--	D
(b) (9)															

Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level Below land surface datum (feet)	Water level Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
(b) (9)															
LJ-65-03-616	Cypress-Fairbanks I.S.D., Well No. 2	Lanford Drilling Co., Inc.	1981	624	10,6	100	524 - 624	EVGL	141	191.00	06/ /1981	T	300	30.00	D,I,Q
LJ-65-03-617	Tifco	Bussell and Son, Inc.	1982	550	8,5	50	447 - 550	CHCT, EVGL	136	155.00	1982	N	--	--	D
(b) (9)															
LJ-65-04-216	First Texas Savings Assoc.	Raymond Water Wells	1983	225	5,2	10	215 - 225	CHCT	125	125.00	04/04/1983	N	15	4.00	D
(b) (9)															

Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level Below land surface datum (feet)	Water level Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
LJ-65-05-312	Lochinvar Golf Club	B.J. Swinehart Co., Inc.	1979	610	8,6	60	330 - 610	CHCT, EVGL	98	136.00	07/ /1979	R	450	55.00	D
LJ-65-05-313	Lochinvar Golf Club	B.J. Swinehart Co., Inc.	1980	620	8,6	60	331 - 616	CHCT, EVGL	98	171.00	06/ /1980	R	420	51.00	D

Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Water level Below land surface datum (feet)	Water level Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
LJ-65-16-723	Litho-Strip	Robinson Water Well	1982	715	6,4	50	630 - 690	EVGL	19	220.00	12/08/1982	C	--	--	D
LJ-65-19-315	Lone Star Cement	Aldine Pump and Well Service, Inc.	1980	360	6,4	20	340 - 360	CHCT	85	150.00	03/26/1980	N	140	--	D

(b) (9)

Table 1.--Records of Wells in Harris County--Continued

Well	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Depth interval (feet)	Water-bearing unit	Altitude of land surface (feet)	Below land surface datum (feet)	Water level Date of measurement	Use of water	Discharge (gallons per minute)	Drawdown (feet)	Type of data available
(b) (9)															
LJ-65-20-323	Cornelius Nurseries, Inc.	Raymond Water Wells	1983	295	5,2	30	250 - 290	CHCT	70	180.00	06/16/1983	C	32	15.00	D
(b) (9)															
LJ-65-21-147	Texaco, Inc.	Raymond Water Wells	1981	475	6,4	30	438 - 468	CHCT	60	250.00	03/05/1981	N	96	2.00	D
(b) (9)															
LJ-65-21-226	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 1	Layne-Texas Co.	1980	2,358	5	20	2,316 -2,336	EVGL	64	302.95	03/12/1980	U	--	--	E,I,J,N, Q,S,W
LJ-65-21-227	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 3	Layne-Western Co., Inc.	1980	1,433	4,2	10	1,418 -1,428	EVGL	64	411.15	04/05/1980	U	--	--	D,Q,W
LJ-65-21-228	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 5	Layne-Western Co., Inc.	1980	253	4,2	10	238 - 248	CHCT	64	177.67	04/09/1980	U	--	--	D,Q,W
LJ-65-21-229	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 4	Layne-Western Co., Inc.	1980	627	4,2	10	612 - 622	CHCT	64	314.21	05/06/1980	U	--	--	D,Q,W
LJ-65-21-230	Harris-Galveston Coastal Subsidence District, Southwest, Well No. 2	Layne-Western Co., Inc.	1980	1,943	4,2	10	1,928 -1,938	EVGL	64	383.72	04/15/1980	U	--	--	D,Q,W
(b) (9)															

UNUSED

REFERENCE 13

RECORD OF COMMUNICATION

TYPE: Phone Call   **DATE:** 5/21/91   **TIME:** 10:50 AM

TO: Dave Terry
Ground Water Conservation
Texas Water Commission
Austin, TX
(512) 371-6321

FROM: Luis Vega
FIT Biologist
ICF Technology, Inc.
Dallas, TX 75201
(214) 744-1641

SUBJECT: Wellhead Protection Program in Southern Harris and Northern Brazoria Counties

SUMMARY OF COMMUNICATION:

Mr. Terry informed me that the City of Houston has implemented a Wellhead Protection Program approved by the State of Texas and the EPA. Houston's municipal wells have exclusion radii of at least ½ mile. This program includes the public supply well at Houston Hobby Airport.

Mr. Terry also informed me that the City of Pearland does not have an approved Wellhead Protection Program at this time.

REFERENCE 14

REFERENCE 15

```
Enter the next ring distance
GEMS>

Enter program execution mode: B (batch) or I (interactive)
GEMS> i
```

Doty Sand Pit
LATITUDE   29:40:48   LONGITUDE   95:35:36   1980 POPULATION

KM	0.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.80-6.40	SECTOR TOTALS
S 1	0	1162	1930	3644	9206	652	16594
S 2	0	0	0	12784	453	27859	41096
S 3	0	0	0	9884	7403	12826	30113
S 4	0	0	0	0	123	0	123
S 5	0	0	7371	9758	0	0	17129
S 6	0	1625	2249	5283	1241	1203	11601
RING TOTALS	0	2787	11550	41353	18426	42540	116656

```
press RETURN to continue
 Esc for ATtention, Home to SWitch      ||      Capture Off         || On: 00:11:58
```

REFERENCE 16

MITRE

REF 16

Ms. Lucy Sibold
U.S. Environmental Protection Agency
401 M Street, S.W.
Room 2636, Mail Code WH-548A
Washington, D.C. 20460

Dear Ms. Sibold:

Enclosed is a copy of the draft revised HRS net precipitation values for 3,345 weather stations where data were available. The data are presented by state code, station name, latitude longitude, and net precipitation in inches. A list of state codes is also enclosed.

The net precipitation values are provided to assist the Phase II Field Testing efforts. It is suggested that the value from the nearest weather station in a similar geographic setting be used as the net precipitation value for a site.

If there are any questions regarding this material, please contact Dave Egan at (703) 883-7866.

Sincerely,

Andrew M. Platt
Group Leader
Hazardous Waste Systems

AMP:DEE/hme

Enclosures

cc: Scott Parrish

OBS	STATE	NAME		LATNUM	LONNUM	NETPREC
2641	41	MC COOK		26.30	98.23	0.3647
2642	41	FALFURRIAS		27.13	98.09	1.0903
2643	41	LAREDO NO 2		27.31	99.28	0.0233
2644	41	KINGSVILLE		27.32	97.53	1.0121
2645	41	ALICE		27.44	98.04	1.6890
2646	41	CORPUS CHRISTI WSO	R	27.46	97.30	1.7390
2647	41	CORPUS CHRISTI		27.48	97.24	1.6836
2648	41	ENCINAL 3 NW		28.05	99.22	0.8944
2649	41	PORT O CONNOR		28.26	96.26	7.9240
2650	41	BEEVILLE 5 NE		28.27	97.42	3.5263
2651	41	COTULLA FAA AIRPORT		28.27	99.13	0.5920
2652	41	PORT LAVACA NO 2		28.38	96.38	8.0207
2653	41	GOLIAD		28.40	97.24	4.8189
2654	41	DILLEY		28.40	99.10	1.5284
2655	41	CRYSTAL CITY		28.41	99.50	0.3470
2656	41	MATAGORDA NO 2		28.42	95.58	9.0031
2657	41	EAGLE PASS		28.42	100.29	0.2235
2658	41	PALACIOS FAA AIRPORT		28.43	96.15	9.8209
2659	41	VICTORIA WSO	R	28.51	96.55	5.0430
2660	41	BAY CITY WATERWORKS		28.59	95.58	9.3658
2661	41	POTEET		29.02	98.35	2.8271
2662	41	DANEVANG 2 SE		29.03	96.11	7.1052
2663	41	ANGLETON 2 W		29.09	95.27	15.2626
2664	41	UVALDE		29.13	99.46	1.1524
2665	41	PIERCE 1 E		29.14	96.11	9.1547
2666	41	NEW GULF		29.16	95.55	8.4050
2667	41	NIXON		29.16	97.45	4.5626
2668	41	CHISOS BASIN		29.16	103.18	0.0000
2669	41	GALVESTON WSO	R	29.18	94.48	8.4385
2670	41	YOAKUM		29.18	97.09	5.7008
2671	41	DEL RIO WSO		29.22	100.55	0.0497
2672	41	HALLETTSVILLE		29.27	96.56	6.6609
2673	41	SAN ANTONIO WSO	R	29.32	98.28	3.7339
2674	41	PRESIDIO		29.33	104.21	0.0000
2675	41	SUGAR LAND		29.37	95.38	11.0523
2676	41	FLATONIA 2 W		29.41	97.08	7.4017
2677	41	LULING		29.41	97.40	6.6844
2678	41	NEW BRAUNFELS		29.42	98.07	6.0682
2679	41	BOERNE		29.47	98.44	5.7313
2680	41	SAN MARCOS		29.53	97.57	7.1484
2681	41	PORT ARTHUR WSO	R	29.57	94.01	16.1905
2682	41	HOUSTON INCONT AP		29.58	95.21	12.3027
2683	41	LIBERTY		30.03	94.49	17.2173
2684	41	BLANCO		30.06	98.25	7.9951
2685	41	BRENHAM		30.09	96.24	11.2405
2686	41	FREDERICKSBURG		30.16	98.52	3.0630
2687	41	AUSTIN WSO	R	30.18	97.42	5.4840
2688	41	CONROE		30.19	95.27	14.9689
2689	41	ALPINE		30.21	103.40	0.0000
2690	41	JUNCTION		30.30	99.47	1.6214
2691	41	SONORA		30.34	100.39	0.8081
2692	41	COLLEGE STATION FAA AP		30.35	96.21	10.9234
2693	41	TAYLOR		30.35	97.24	8.7022
2694	41	MOUNT LOCKE		30.40	104.00	0.0615
2695	41	HUNTSVILLE		30.43	95.33	14.0649

REFERENCE 17

Report 289

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER HYDROLOGY OF THE CHICOT AND EVANGELINE AQUIFERS ALONG THE GULF COAST OF TEXAS
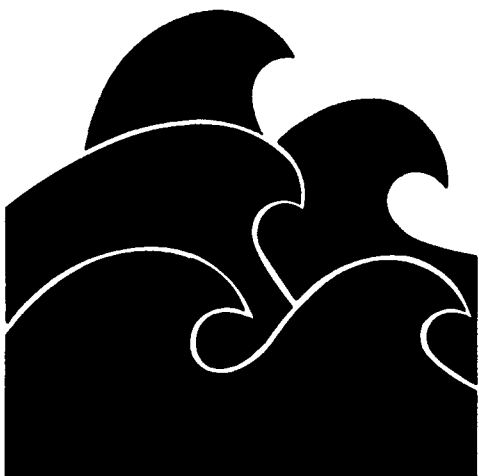
TEXAS DEPARTMENT OF WATER RESOURCES

May 1985

TEXAS DEPARTMENT OF WATER RESOURCES

REPORT 289

DIGITAL MODELS FOR SIMULATION OF GROUND-WATER

HYDROLOGY OF THE CHICOT AND EVANGELINE

AQUIFERS ALONG THE GULF COAST OF TEXAS

By

Jerry E. Carr, Walter R. Meyer,
William M. Sandeen, and Ivy R. McLane
U.S. Geological Survey

May 1985

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TABLE OF CONTENTS—Continued

TABLE

FIGURES

TABLE OF CONTENTS—Continued

TABLE OF CONTENTS—Continued

Metric Conversions

Metric equivalents of "inch-pound" units of measurement are given in parentheses in the text. The "inch-pound" units may be converted to metric units by the following conversion factors:

From	Multipy by	To obtain
foot	0.3048	meter (m)
foot $^{-1}$	3.2802	meter $^{-1}$ (m $^{-1}$)
foot per day (ft/d)	0.3048	meter per day (m/d)
foot squared per day (ft^2/d)	0.0929	meter squared per day (m^2/d)
inch per year (in/yr)	2.54	centimeter per year (cm/yr)
mile	1.609	kilometer (km)
million gallons per day	0.04381	cubic meter per second
square mile	2.590	square kilometer (km^2)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

HYDROGEOLOGY OF THE TEXAS GULF COAST

The hydrogeologic units are the Chicot aquifer, Evangeline aquifer, and the Burkeville confining layer (Figures 2 and 3). These units are composed of sedimentary deposits of gravel, sand, silt, and clay. The geologic formations, from oldest to youngest, are: the Fleming Formation and Oakville Sandstone of Miocene age; the Goliad Sand of Pliocene age; the Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Clay of Pleistocene age; and alluvium of Quaternary age. The relationship between the hydrogeologic units and the geologic formations (stratigraphic units) is given in Table 1. With exception of the alluvium and the Goliad Sand, the formations crop out in belts that are nearly parallel to the shoreline of the Gulf of Mexico. The Goliad Sand is overlapped by younger formations east of the Brazos River and is not exposed at the surface in the coastal area. The younger formations crop out nearer the Gulf and the older ones farther inland. All formations thicken downdip towards the Gulf of Mexico so that the older formations dip more steeply than the younger ones. Locally, the occurrence of salt domes, faults, and folds may cause reversals of the regional dip and thickening or thinning of the formations.

Table 1.--Geologic and Hydrologic Units Used in This Report and in Recent Reports on Nearby Areas

Geologic classification			Hydrologic units						
System	Series	Stratigraphic unit	Houston district (Lang, Winslow, and White, 1950)	Houston district (Wood and Gabrysch, 1965)	Texas-Louisiana (Turcan, Wesselman, and Kilburn, 1966)	Houston district (Jorgensen, 1975)		This report	
Quaternary	Holocene	Quaternary alluvium	Alluvial deposits	Confining layer and Alta Loma Sand of Rose (1943)	Chicot aquifer	Chicot aquifer	Upper unit	Chicot aquifer	Upper unit
	Pleistocene	Beaumont Clay	Beaumont Clay / "Alta Loma Sand"						
		Montgomery Formation							
		Bentley Formation					Lower unit		Lower unit
		Willis Sand	Zone 7						
			Zone 6						
	Pliocene	Goliad Sand	Zone 5	Heavily pumped layer	Evangeline aquifer	Evangeline aquifer		Evangeline aquifer	
Tertiary			Zone 4						
			Zone 3						
		Fleming Formation							
	Miocene		Zone 2	Zone 2	Burkeville confining layer	Burkeville confining layer		Burkeville confining layer	
		Oakville Sandstone	Zone 1		Jasper aquifer	Jasper aquifer			

-6-

Chicot Aquifer

The Chicot aquifer is composed of the Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Clay, and Quaternary alluvium. The Chicot includes all deposits from the land surface to the top of the Evangeline aquifer. The altitude of the base of the Chicot aquifer is shown in Figures 4 and 5.

In much of the coastal area, the Chicot aquifer consists of discontinuous layers of sand and clay of about equal total thickness. However, in some parts of the coastal area (mainly within the Houston area), the aquifer can be separated into an upper and lower unit (Jorgensen, 1975). The upper unit can be defined where the altitude of its potentiometric surface differs from the altitude of the potentiometric surface in the lower unit. If the upper unit of the Chicot aquifer cannot be defined, the aquifer is said to be undifferentiated. The aquifer is under water-table conditions in its updip part, becoming confined in the downdip direction. Throughout most of Galveston County and southeast Harris County, the basal part of the Chicot aquifer is formed by a massive sand section that has a relatively high hydraulic conductivity. This sand unit, which is heavily pumped in some places, is known locally as the Alta Loma Sand (Alta Loma Sand of Rose, 1943).

Evangeline Aquifer

The Evangeline aquifer, which consists mostly of discontinuous layers of sand and clay of about equal total thickness, is composed of the Goliad Sand and the uppermost part of the Fleming Formation. The altitude of the base of the Evangeline aquifer is shown in Figures 6 and 7. Because the Chicot and Evangeline aquifers are geologically similar, the basis for separating them is primarily a difference in hydraulic conductivity, which in part causes the difference in the altitudes of the potentiometric surfaces in the two aquifers. The aquifer is under water-table conditions in its updip part, becoming confined in the downdip direction.

Burkeville Confining Layer

The Burkeville confining layer, which is composed of the upper part of the Fleming Formation, consists mainly of clay but contains some layers of sand. The Burkeville, which underlies the Evangeline aquifer, restricts the flow of water except in areas where it is pierced by salt domes and in areas where it contains a high percentage of sand.

DESCRIPTION OF THE DIGITAL MODELS

The conceptual model (Figure 8) for the four modeled subregions (Figure 9) consists of five layers. In ascending order, layer 1 is equivalent to the total thickness of the sand beds in the Evangeline aquifer; layer 2 is equivalent to the clay thickness between the centerline of the Chicot aquifer and the centerline of the Evangeline aquifer; layer 3 is equivalent to the Alta Loma Sand of Rose (1943) where present, otherwise it is equivalent to the total thickness of the sand beds in the Chicot aquifer; layer 4 is equivalent to the clay thickness between the land surface and the centerline of the Chicot aquifer; and layer 5 is used as an upper boundary to simulate recharge to
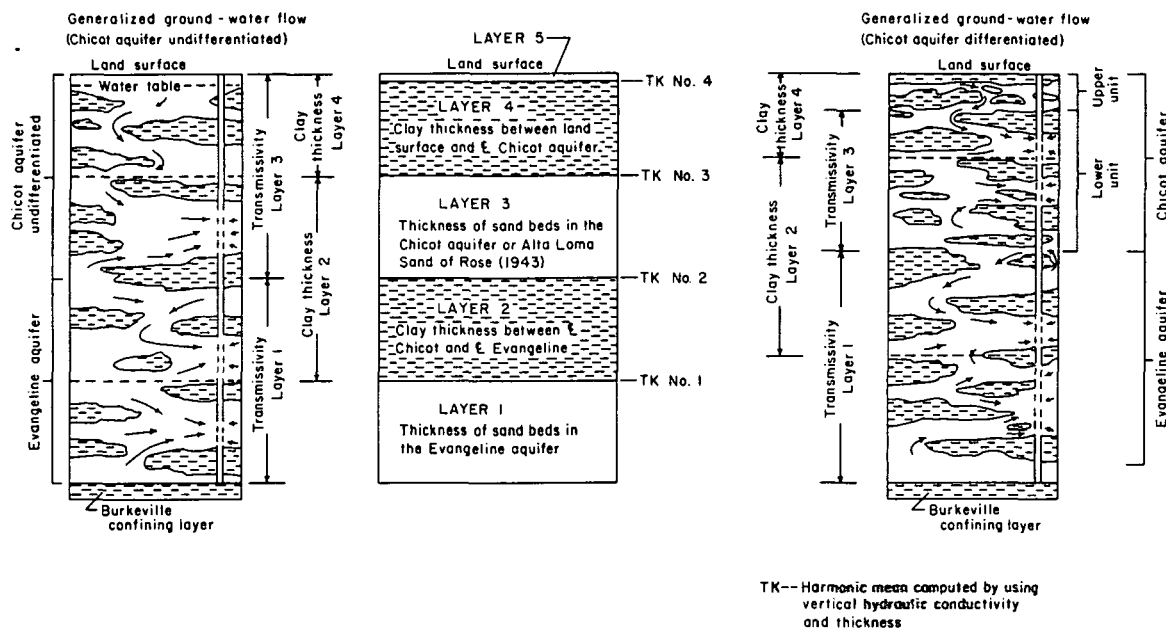
Figure 8.—Conceptual Model of the Ground-Water Hydrology of the Texas Gulf Coast

the system from vertical leakage. Within the model, clay thickness intervals are divided at aquifer centerlines to support the concept that the upper clays (layer 4) mostly control the vertical flow to the Chicot sands (layer 3), and that the clays (layer 2) from the centerline of the Chicot aquifer to the centerline of the Evangeline aquifer mostly control the vertical flow between the two aquifers.

The Burkeville confining layer (base of model) is assumed for modeling purposes to form a barrier that allows only a negligible flow of water. Salt domes, which occur throughout the study area, were not considered in the construction of the models because they have only a localized effect on ground-water conditions. In most areas, the domes do not pierce the Chicot or Evangeline aquifers.

Selection of horizontal boundaries for the models was somewhat arbitrary because the Chicot and Evangeline aquifers form an extensive and continuous hydrologic system along the Texas Gulf Coast. The no-flow boundaries selected were primarily determined by the areal extent required to minimize the effects of pumping along the boundaries and to eliminate the necessity of having flux boundaries.

The digital models used in this study are finite-difference models as modified from Trescott (1975) for simulation of three-dimensional ground-water flow; the models converge to a solution rapidly because all equations are solved simultaneously rather than sequentially as in the quasi three-dimensional model of Bredehoeft and Pinder (1970). The iterative numerical technique used to solve the set of simultaneous finite-difference equations is the strongly implicit procedure originally described by Stone (1968) for problems in two dimensions. Wienstein, Stone, and Kwan (1969) later extended the technique to three dimensions.

The model developed by Trescott (1975) was modified by J. E. Carr (Meyer and Carr, 1979) to include methods to increase or decrease the values of storage in the clay layers, at a head that is equivalent to preconsolidation stress, to simulate land-surface subsidence. This reference head is arbitrarily referred to as "critical head." Different storage coefficients, which are head depen-

periods. The distribution of withdrawals by aquifer was based on the proportion of well screens in each aquifer. Withdrawals from the upper unit of the Chicot aquifer were not modeled because withdrawals are minor in most areas.

Transmissivities

Estimates of transmissivity were originally determined from aquifer-test data by using either the Theis (1935) equation or the modified Hantush (1960) equation as outlined by Lohman (1972, p. 15-19, p. 32-34). Distribution of the estimated transmissivity was then made by multiplying the sand thickness of the aquifer at a given location by the average hydraulic conductivity as determined from the estimates of transmissivity for a given area. It should be noted that because of violations of the assumptions used by the analytical equations, the transmissivities as determined from aquifer-test data are only approximations. Therefore, the transmissivities were used to define a reasonable range of values to be tested in the models.

The areal distributions of the transmissivities of the Chicot and Evangeline aquifers that were refined through model calibrations are shown in Figures 12-15. The transmissivity of the Chicot aquifer ranged from about 3,000 ft²/d (279 m²/d) to about 50,000 ft²/d (4,645 m²/d). The transmissivity of the Evangeline aquifer ranged from about 3,000 ft²/d (279 m²/d) to about 15,000 ft²/d (1,394 m²/d).

Storage Coefficients

Aquifers

Estimates of the storage coefficients of the aquifers were originally determined from aquifer-test data that were analyzed by the Theis (1935) equation or the modified Hantush (1960) equation, and multiplication of the average sand thickness of the aquifer by 1.0×10^{-6} feet^{-1} (3.3 $\times 10^{-6}$ m $^{-1}$) as suggested by Lohman (1972). The areal distribution of storage coefficients that were obtained by model calibration is shown in Figures 12-15. The storage coefficient of the Chicot aquifer ranged from about 0.0004 to about 0.1; the storage coefficient of the Evangeline aquifer ranged from about 0.0005 to about 0.1. The larger values are in the outcrop areas where the aquifers are under water-table conditions; the smaller values are in the artesian zones.

Clay Beds

The storage coefficients of the clay beds are included in the models because considerable amounts of water are released from the clay beds as water is pumped from the aquifers. This release of water allows the clay beds to compact, which in turn causes subsidence of the land surface. In the Houston area, subsidence is directly proportional to the volume of water derived from the clay beds because nearly all of the subsidence is related to ground-water pumping. In other parts of the coastal area, subsidence is related to the production of oil and gas in addition to ground-water pumping.

The rate and amount of compaction of the clay beds is dependent on overburden loading, hydraulic conductivity of the clays, previous compaction, length of the drainage path, and charac-

teristics of the clays. In general, clays compact more rapidly if the pressure causing compaction is greater than previous pressure or "preconsolidation load." Reported values of the "compaction ratio," *which is the ratio of the volume of land-surface subsidence to the volume of water pumped,* range from about 0.17 to 0.22 in the Houston area (Jorgensen, 1975, p. 49).

By relating subsidence of the land surface, clay thickness, and decrease in artesian pressure, the following method was used to derive the storage coefficients of the clay beds in the Houston area. *The assumption was made that one-half of the subsidence occurred in model layer 2 and one-half occurred in layer 4. Distribution of clay-storage values for layers 2 and 4 were obtained for 1943-73 by first calculating specific unit-compaction where subsidence data were available.* The specific unit-compaction for the clay in layer 4 was determined at a given node as follows:

$$
\begin{array}{l}
\text{Specific unit-} \\
\text{compaction in} \\
\text{layer 4}
\end{array}
=
\frac{\text{1/2 total subsidence for the time period}}{
\begin{array}{l}
\text{clay thickness} \\
\text{in layer 4}
\end{array}
\times
\begin{array}{l}
\text{artesian-pressure} \\
\text{decrease in the} \\
\text{Chicot aquifer} \\
\text{for a given time} \\
\text{period}
\end{array}
}
\qquad (1)
$$

The specific unit-compaction for the clay in layer 2 was determined in a similar manner by using the clay thickness in layer 2 and the artesian-pressure decrease in the Evangeline aquifer. The two specific unit-compaction values were then averaged to compute a mean specific unit-compaction for layers 2 and 4. The mean value for each layer was then multiplied by the thickness of clay (Figures 16-19) at each node to obtain the storage coefficients for each layer.

Specific unit-compaction values are an approximation of specific storage if the resulting compaction approximates the ultimate compaction expected from an applied stress. The mean specific unit-compaction values determined for the model of the Houston subregion for 1943-73 are 1.0×10^{-4} feet^{-1} (3.2×10^{-4} m^{-1}) for layer 4 and 1.8×10^{-5} feet^{-1} (5.9×10^{-5} m^{-1}) for layer 2. The inelastic storage coefficients used in the models, which were obtained as the product of the mean specific unit-compaction and the clay thickness, ranged from 5.8×10^{-3} to 5.0×10^{-2}. In comparison, the minimum inelastic storage coefficients for the clay beds, as indicated by the ratio of subsidence to water-level declines, ranged from 5×10^{-3} to 3×10^{-2} (Jorgensen, 1975, p. 44). Elastic storage coefficients used in the models for the clay beds were obtained from model calibrations.

The decision to assign one-half of the subsidence to layer 2 and one-half to layer 4 for calculating specific unit-compaction was based primarily on data from a compaction monitor at Seabrook. Data from this site indicated that about 55 percent of the subsidence resulted from compaction of the clay beds in the Chicot aquifer and about 45 percent resulted from compaction of the clay beds in the Evangeline aquifer. However, because of the lack of data to define a more accurate spatial distribution of clay storage, 50 percent of the subsidence was assigned to each unit on a regional basis. The error resulting from this assumption is minimized because even though the specific unit-compaction of the Evangeline aquifer usually is smaller than that of the Chicot aquifer, the clay thickness and water-level declines in the Evangeline usually are greater. Therefore, the amount of subsidence occurring within each unit tends to be approximately equal. In addition, the calibration procedure indicated that the models are only moderately sensitive to storage in clay beds, which would further minimize the error of this assumption.

The storage coefficients of the clay beds were used in the model to represent approximately the elastic response for a stress that is less than the preconsolidation loading and to represent approximately the inelastic response for a stress exceeding the preconsolidation loading. These storage coefficients, or slightly modified coefficients, were used later in the other modeled subregions.

A preconsolidation-stress variable (critical head) is used in the models to control the initial change in storage in clay beds at any given node as a function of head decline. This variable represents the maximum antecedent effective stress to which a deposit has been subjected and the stress that it can withstand without undergoing permanent deformation. Stress changes less than the preconsolidation stress produce elastic deformations of small magnitude. Within this range, the clay beds have smaller storage coefficients than if the preconsolidation stress is exceeded.

The preconsolidation stress approximates the maximum effective stress to which deposits within the study area have been subjected prior to ground-water development. This preconsolidation stress, as determined by calibration of the model of the Houston subregion, is 70 feet (21 m), which means that 70 feet (21 m) of head decline must occur at a node before the model converts to an inelastic storage value. However, the lowest head value computed at a node is retained and becomes the control for changes in storage in clay beds after the preconsolidation stress is reached. The preconsolidation stress of 70 feet (21 m) was assumed to be applicable in the models of the other subregions.

The maximum effective stress to which the clay deposits at a node have been subjected is represented by the lowest head value. After the initial change in head at a node, storage in clay beds is allowed to return to preconsolidation values when the computed head rises above the lowest head value retained. If the head declines below the lowest head value retained, storage is again changed to the consolidation value for that node.

The quantity of water that was derived from storage in the clay beds was computed by the models and summarized as a total contribution from the clay beds. The volume per model node was obtained by multiplying the water-level decline, in feet, by the apparent storage coefficient and by the area of the node, in square feet. The volume of water that originated in the clay beds ranged from 16 to 31 percent of the water pumped in the model simulations.

Effective Vertical Hydraulic Conductivity and Vertical Leakage

The effective vertical hydraulic conductivity of the aquifers is controlled primarily by the clay beds that occur within the vertical sequence of sand beds. By using three different clay layers, Jorgensen (1975, p. 54) estimated that the effective vertical hydraulic conductivity ranges from as little as 10^{-7} ft/d (0.3×10^{-7} m/d) to as much as 1 ft/d (0.3 m/d). Because of the large differences in the estimated effective vertical hydraulic conductivity, the values used in the models were determined by model calibration.

Effective vertical hydraulic conductivity as determined by calibration of the models ranged from 9.2×10^{-5} to 2.3×10^{-4} ft/d (2.8×10^{-5} to 0.7×10^{-5} m/d). The effective vertical hydraulic conductivity from the land surface to the centerline of the Chicot aquifer ranged from 3.2×10^{-5} to 2.3×10^{-4} ft/d (0.98×10^{-6} to 0.7×10^{-5} m/d). The effective vertical hydraulic conductivity from

the centerline of the Chicot aquifer to the centerline of the Evangeline aquifer ranged from 9.2×10^{-5} to 4.6×10^{-3} ft/d (2.8×10^{-5} to 1.4×10^{-3} m/d).

Vertical leakage from the uppermost layer ranged from 21 to 47 percent of the amount of water pumped in the model simulations. The maximum vertical leakage per square mile ranged from 0.24 to 4.3 in/yr (0.61 to 10.9 cm/yr) at the end of 1975.

Declines in the Altitudes of the Potentiometric Surfaces

Maps showing declines in the altitudes of the potentiometric surfaces were constructed for the lower unit of the Chicot aquifer, the Chicot aquifer undifferentiated, and the Evangeline aquifer. Maps for the Houston subregion were constructed for 1890-1970 and 1890-1975. Maps for the other subregions were constructed for 1900-1970 and 1900-1975.

The maps were constructed to show the approximate altitude of the potentiometric surface at the centerline of the aquifer. However, it should be noted that wells screened at different depths in an anisotropic aquifer will probably have different depths to water, even if the wells are within a few feet of each other. Most single-screened wells in an area will have depths to water of about plus or minus 10 feet (3 m) of the depth used to construct the maps showing the declines in the altitudes of the potentiometric surfaces.

CALIBRATION AND SENSITIVITY OF THE MODELS

The models were calibrated by simulating the declines in the altitude of the potentiometric surfaces and comparing the simulated declines to the declines obtained from historic measurements for all models from 1890 or 1900 to 1970 except the Houston model, which was calibrated from 1890 or 1900 to 1975. Where the comparison of the observed declines and the simulated declines was poor, the hydrologic properties were modified and the models were tested again. This procedure was continued until the models satisfactorily simulated the observed declines. The grid patterns of the models, the observed and simulated declines in the altitude of the potentiometric surfaces, and the observed and simulated subsidence of the land surface are shown as follows:

Eastern-subregion model — Figures 20-25
Houston-subregion model — Figures 26-31
Central-subregion model — Figures 32-37
Southern-subregion model — Figures 38-43

For each of the subregions, the models were calibrated on "minimodels" (grids not shown). Each minimodel grid was composed of about one-half or less of the number of nodes that were used in the maximodel grids. Programs were written to transfer data from the maximodels to the minimodels. Results are shown from the maximodel runs in this report. The use of the "minimodels" permitted a number of relatively inexpensive computations to be used in calibrating the models. The calibrations indicated that the models were very sensitive to variations in storage in water-table aquifers and transmissivity. They are less sensitive to variations in storage in artesian aquifers and to variations in storage in clay beds. Previous testing of the model of the Houston area (Meyer and Carr, 1979) with a constant-head boundary showed that the boundary effects were minimal within short distances of the boundaries.

Some important relationships that were indicated by the calibration procedure are:

1. A large part of the Chicot aquifer in the updip section is under water-table conditions.

2. Vertical leakage of water, exclusive of irrigation returns, from the land surface to the lower part of the Chicot aquifer is an important part of the hydrologic system; however, this *decreases in importance in the southern subregion.*

3. Transmissivity values as determined by model calibration are about 70 to 80 percent of the *value obtained by the Theis equation alone.*

4. Verification was made of the interpretation by Jorgensen (1975) that in the Katy area, large amounts of water are exchanged between aquifers through irrigation wells and other wells that are open to more than one aquifer; and as much as 30 percent of the water pumped for irrigation returns to the Chicot aquifer in this area.

LIMITATIONS ON USE OF THE MODELS

The values of the hydrologic properties modeled are rational values for the hydrologic system; however, further investigations and the acquisition of additional data will allow more accurate determination of these values. The models were designed to simulate the effects of withdrawals of water from a well field for periods of 1 year or longer; the models were not designed to simulate the effects of one well pumping for a short period of time. The models were not designed to predict land-surface subsidence accurately; although the simulation of clay compaction was included. For a more accurate simulation of subsidence, more detailed data on local areas will be needed.

DATA NEEDED FOR IMPROVEMENT OF THE MODELS

The hydrologic data that are most needed to improve the models are: (1) Water-level data from observation wells that are screened in only one water-bearing unit; (2) additional data on the quantity of water pumped for irrigation; (3) more accurate determination of storage coefficients for the clay beds in each aquifer; (4) data to determine compaction coefficients for areas outside the Houston area; and (5) more detailed information on the thickness of the clay beds.

SUMMARY

The Texas Gulf Coast has two major aquifers above the Burkeville confining layer, the Chicot and the Evangeline. Both aquifers consist of alternating layers of sand and clay that dip gently towards the Gulf of Mexico. The Chicot aquifer is the uppermost one and in some places along the coast, mainly in the Houston area, it can be separated into an upper and a lower unit. The upper unit, which is not an important source of water along most of the Texas Gulf Coast, can be separated from the lower unit by differences in hydraulic head. Where the units cannot be separated, the aquifer is said to be undifferentiated. The Evangeline aquifer underlies the Chicot aquifer and also can be separated from it by a difference in head.

Large withdrawals of ground water along the coast have resulted in major cones of depres-
sion in the potentiometric surface in the lower unit of the Chicot aquifer and the Evangeline
aquifer. Withdrawals of ground water have also resulted in land-surface subsidence along the
coast of as much as 8.5 feet (2.6 m) within the Houston area.

Digital-computer models were constructed to study the hydrology of the coastal area and to
simulate the decline in the altitude of the potentiometric surfaces. The models were verified,
where possible, for declines in the altitude of the potentiometric surface of both aquifers from
1890 to 1975 for the Houston subregion and from 1900 to 1970 for all other subregions. In
addition, all models also were verified for the volume of water derived from clay compaction
where possible. The models are very sensitive to variations in aquifer transmissivity and in
storage in water-table aquifers; they are less sensitive to variations in storage in artesian aquifers
and in clay beds.

The model results indicate that a large part of the Chicot aquifer in the updip section is under
water-table conditions, that vertical leakage is an important part of the hydrologic system, and
that transmissivity values as determined by model calibration are about 70 to 80 percent of those
obtained by the Theis equation alone.
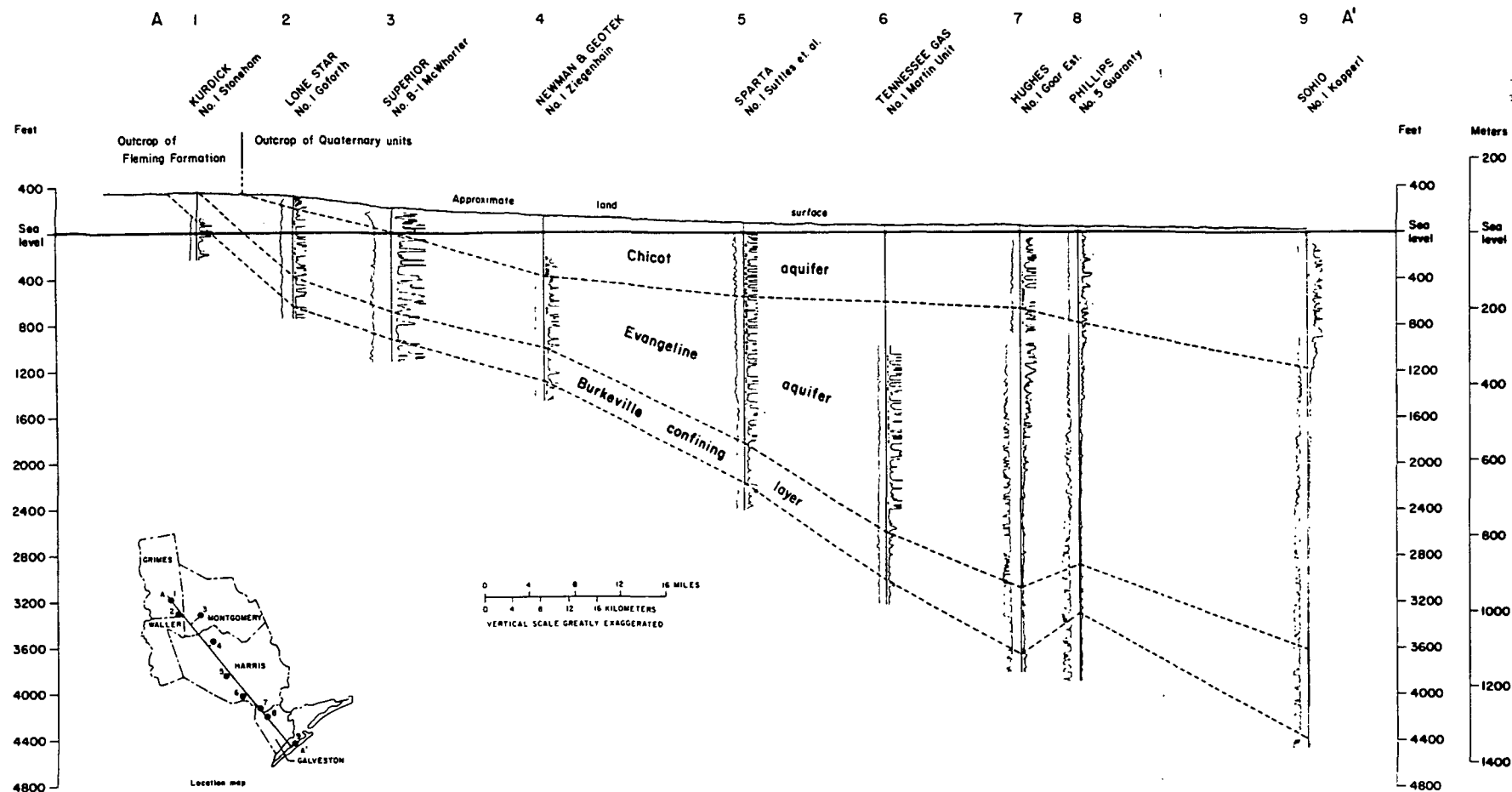
Figure 2
Hydrogeologic Section in Northern Region

REFERENCE 18

Water Resources Data

Texas

Water Year 1990

Volume 2. San Jacinto River Basin, Brazos River Basin,
San Bernard River Basin, and
Intervening Coastal Basins

Volume 1.
Arkansas River
Basin, Red
River Basin.

Sabine River Basin
Volume 2.
San Jacinto River Basin,
Brazos River Basin, San
Bernard River Basin; and
Intervening Coastal Basins.
Neches River Basin,
Trinity River Basin
and Intervening
Coastal
Basins

Volume 3.
Colorado River Basin,
Lavaca River Basin,
Guadalupe River Basin,

Nueces River Basin,
Rio Grande Basin, and
Intervening Coastal
Basins
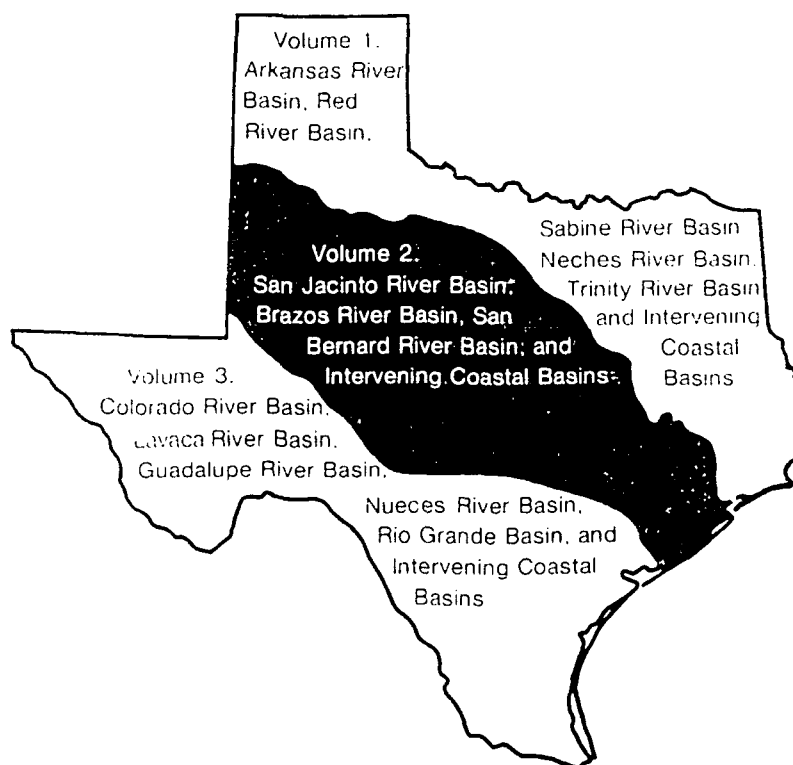
U.S. GEOLOGICAL SURVEY WATER-DATA REPORT TX-90-2
Prepared in cooperation with the State of Texas
and with other agencies

08075000 BRAYS BAYOU AT HOUSTON, TX

LOCATION.--Lat 29°41'49", long 95°24'43", Harris County, Hydrologic Unit 12040104, near right bank at downstream side of Main Street Bridge in southwest Houston, 1.6 mi upstream from Harris Gully, and 11.6 mi upstream from Buffalo Bayou.

DRAINAGE AREA.--94.9 mi². Prior to October 1976, 88.4 mi². Changes due to drainage ditch relocations.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1936 to current year.

REVISED RECORDS.--WSP 1732: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 7.16 ft below National Geodetic Vertical Datum of 1929, 1973 adjustment; unadjusted for land-surface subsidence. Prior to June 20, 1936, nonrecording gage, and June 20, 1936, to Nov. 25, 1959, water-stage recorder at site 0.8 mi downstream at same datum.

REMARKS.--Records fair except those for estimated daily discharges, which are poor. There no known diversions above station. Low flow is mostly sewage effluent from Houston suburbs. Gage-height telemeter at station.

AVERAGE DISCHARGE.--54 years, 139 ft³/s (100,700 acre-ft/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 29,000 ft³/s June 15, 1976, and Sept. 19, 1983 (gage height, 52.13 ft); minimum daily, 0.1 ft³/s Oct. 11, 12, 1937, Mar. 14, Apr. 1, 1958.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage since 1911, 56.0 ft in June 1919 before channel rectification, former site, from information by engineer for city of Houston.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 7,300 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Oct. 29	1600	10,200	39.73	May 17	1730	9,710	39.30
Apr. 26	1600	*10,400	*39.94				

Minimum daily discharge, 94 ft³/s Nov. 3.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	101	126	96	112	230	1610	240	129	128	143	131	142
2	103	129	98	124	259	601	220	118	109	111	185	139
3	106	94	99	268	135	194	142	1270	107	99	127	114
4	106	96	99	162	122	136	129	666	110	98	105	139
5	101	240	97	192	104	122	124	173	106	338	100	116
6	99	276	98	781	105	113	271	130	105	181	105	170
7	104	139	96	518	99	102	132	120	103	115	100	113
8	103	100	97	151	185	114	118	269	103	155	100	120
9	101	97	101	116	344	116	116	141	102	110	99	394
10	98	99	101	108	359	108	173	115	100	100	105	474
11	99	e100	101	102	119	115	193	112	113	100	102	594
12	96	e100	96	102	114	242	116	108	136	150	100	150
13	98	101	98	100	98	206	113	110	117	112	100	603
14	97	102	97	100	103	164	652	113	111	98	105	198
15	108	101	97	106	220	180	201	115	108	98	115	160
16	111	97	98	99	122	120	127	117	100	130	115	139
17	105	95	95	103	105	117	119	1630	101	128	104	209
18	96	137	100	101	278	110	113	624	105	258	110	186
19	101	229	108	570	159	118	115	169	102	152	111	127
20	104	158	105	345	116	104	116	130	106	117	107	131
21	98	109	101	121	1280	102	115	120	100	110	315	114
22	101	407	103	101	409	108	114	249	105	112	368	105
23	105	167	108	97	155	103	111	208	105	256	181	100
24	107	99	122	217	120	104	115	118	112	124	136	99
25	105	98	119	157	106	105	112	116	189	100	108	98
26	750	101	123	99	109	106	2380	105	386	98	107	98
27	132	116	117	99	106	104	1170	103	194	98	110	98
28	95	871	122	738	975	393	1610	105	123	98	130	97
29	1480	115	229	458	---	1170	239	107	110	96	117	96
30	1830	97	188	135	---	1150	154	106	175	100	106	96
31	355	---	120	101	---	309	---	106	---	297	100	---
TOTAL	7195	4796	3429	6583	6636	8446	9650	7802	3771	4282	4004	5419
MEAN	232	160	111	212	237	272	322	252	126	138	129	181
MAX	1830	871	229	781	1280	1610	2380	1630	386	338	368	603
MIN	95	94	95	97	98	102	111	103	100	96	99	96
AC-FT	14270	9510	6800	13060	13160	16750	19140	15480	7480	8490	7940	10750

CAL YR 1989 TOTAL 98789 MEAN 271 MAX 9660 MIN 91 AC-FT 195900
WTR YR 1990 TOTAL 72013 MEAN 197 MAX 2380 MIN 94 AC-FT 142800

e Estimated

REFERENCE 19

RECORD OF COMMUNICATION

TYPE: Telephone Call   **DATE:** April 2, 1992   **TIME:** 10:27 a.m.

TO: John Brock
Vice President of Operations
Muni Service Corp., Texas
713-772-3631

FROM: Bret Kendrick
Geologist
ICF Technology
Dallas, Texas
214-979-3905

SUBJECT: (b) (9)

SUMMARY OF COMMUNICATION:

I told Mr. Brock that I was trying to get information about particular water wells within the (b) (9) (b) (9) on the topographic map) and (b) (9) on the topographic map).

Mr. Brock informed me that both wells were still in operation. The water well in (b) (9) is located at (b) (9). He told me that it has approximately 444 connections and is strictly part of a ground water system and not a blended system.

The water well in the (b) (9) is located at (b) (9) Mr. Brock told me that it has approximately 1,340 connections and that it also is strictly part of a ground water system and not a blended system.

Both wells draw from the Evangeline Aquifer.

Mr. Brock also said there is a well located at (b) (9) and (b) (9) which served Fame City Water Works. Fame City Water Works is a water amusement park located 1 mile east of Highway 6.

REFERENCE 20

RECORD OF COMMUNICATION

TYPE:	Telephone Call	**DATE:**	4-2-92	**TIME:**	3:25 p.m.

TO: Rick Van Dyke
Client Relations Manager
EcoResources, Texas
713-240-1300

FROM: Bret Kendrick
Geologist
ICF Technology, Inc.
Dallas, Texas
214-979-3905

SUBJECT: (b) (9)

SUMMARY OF COMMUNICATION:

I told Mr. Van Dyke that I was trying to gather information about a water well within the (b) (9) (b) (9) The particular well in question is (b) (9) within (b) (9) on the topographic map). He informed me that the well in question is still in operation and that it has approximately 1,700 connections. He also stated that the water well is strictly part of a ground water system and not part of a blended system. The well is located at (b) (9) The well draws from the Evangeline Aquifer.

REFERENCE 21

RECORD OF COMMUNICATION

REF 21

TYPE:	Telephone Call	**DATE:**	4-2-92	**TIME:**	10:15 a.m.

TO: Tom Dunn
Vice President
Texas Enterprises, Inc.
Texas
713-444-7442

FROM: Bret Kendrick
Geologist
ICF Technology, Inc.
Dallas, Texas
214-979-3905

SUBJECT: (b) (9)

SUMMARY OF COMMUNICATION:

I told Mr. Dunn that I was attempting to gather information on a water well in (b) (9) (b) (9) I told him that the particular well in question was (b) (9) on the topographic map. He told me that the well in question is located at (b) (9) . He also told me that it is still in operation and that it has approximately 2,000 connections. The well is strictly a ground water system and not part of a blended system. The well draws from the Evangeline Aquifer.

REFERENCE 23

RECORD OF COMMUNICATION

TYPE: Telephone Call   **DATE:** 4/23/92   **TIME:** 9:30 a.m.

TO: Patsy McKnight
Southern Municipal Services
Mission Bend MUD #2
713-980-2476

FROM: Kevin Jaynes
Site Manager
ICF Technology, Inc.
Dallas, Texas
214-979-3900

SUBJECT: (b) (9)

SUMMARY OF COMMUNICATION:

Ms. McKnight informed me that there are 317 connections for the (b) (9)
(b) (9)